EDITORIAL

ATN'S coverage of the Queen Mother's visit to Canberra was more than a stunt.

It was a spectacular attempt to widen its activities beyond the primary purpose of a TV station—provision of programmes and entertainment from the local scene.

Sooner or later—I hope sooner—TV must set out to cover the continent.

ATN provided sharp proof that it can be done now, at least in part, if those who want it have enough initiative, and command equipment within the normal requirements of a well-planned station.

It was significant that the first big hop should have been to Canberra to cover an event of national importance. It was with this knowledge in mind that ATN's facilities were made available to the other Sydney stations, without prejudice to the prestige of either.

Now that the ice has been broken, is it too much to expect that strenuous efforts will be made to follow up this success?

For whether we like it or not, the stature of TV in Australia is destined to increase much more quickly than it did overseas. And the very fact that our major centres are so dispersed makes early linkage of programme material all the more urgent.

The obvious channel which should be created without delay lies between Sydney and Melbourne. It is along this line, passing as it does through Canberra, that most of our national events take place.

Later on, extensions from either end will take in Adelaide and Brisbane, and points on the way.

We have at least two important items, both first-class TV material, coming up later in the year.

One is the Melbourne Cup, which creates more national interest than any other single event.

The other is the England-Australia Test series.

We saw the impact made on viewers by Davis Cup matches. Stations used fast aircraft to fly films across the country, but how much greater was the interest in the direct telecasts.

Isn't there time for a combined effort by stations at each end and the P.M.G.? Between them they could pioneer the overland link.

I think the public is justified in hoping that they will.

John Moyle

INDEX

The Start of a Long Journey 3
Solving the Riddle of Super-Conductivity 4
ATN's Historic Microwave Link .. 11
Whistlers May Guide Signals 15
Let's Look At Guided Missiles 17
Wireless Mic. Works on 460 Kc .. 21
Induction Pickup for Drive-In Theatres 25
Paper Work Speeded by Number Reader 27
News and Views of the Month 29
Transistor Telephone Amplifier 32
All About Audio & Hi-Fi—Part 6 .. 41
Console Cabinet For Your TV 48
How To Get Your Amateur Licence 53
From the Serviceman Who Tells .. 59
35-Watt Amplifier with Control Unit 64
Here's Your Answer Tom 74
New Light On the VCR97 79
Improvements to Synch. Separators 80
A Course In Television—Part 29 .. 85
Application of Thermistors 91
Let's Buy An Argument 96
Off The Record 102
Short Wave Notes 112
The Ham Bands 113
Answers To Correspondents 125

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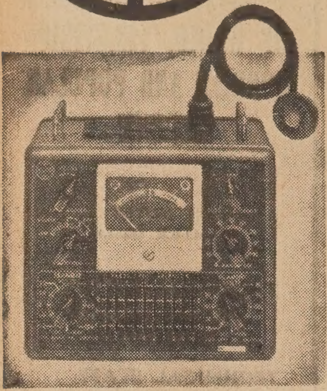

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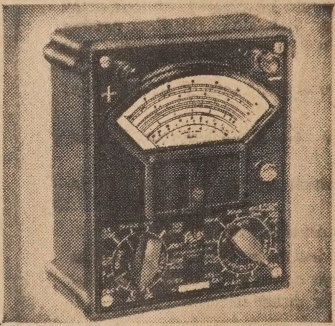

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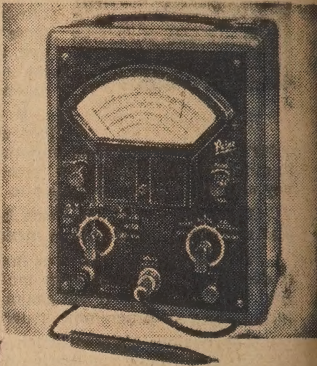

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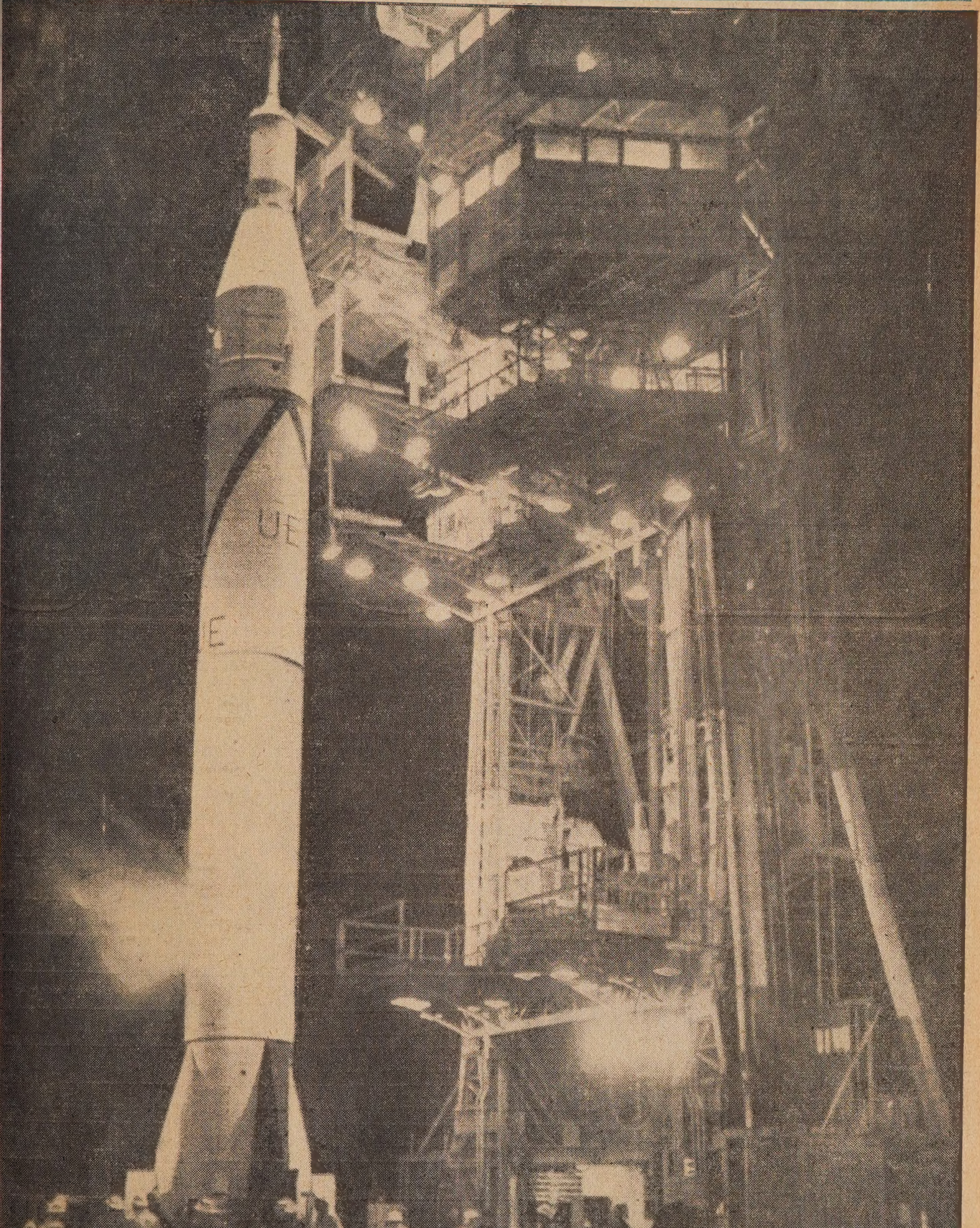
THE START OF A LONG JOURNEY



TELLITE ABOUT TO LEAVE—an outstanding photograph of the Jupiter-C missile prior to launching of the first U.S.A. earth satellite at Cape Canaveral. (See story page 16).

Solving The Riddle Of Superconductivity

By B. T. MATTHIAS

Superconductivity is the property exhibited by certain metals by which they lose all electrical resistance when cooled to a few degrees above absolute zero Although the phenomenon has not been completely explained, it has now been found to adhere to some simple rules. At the moment its main interest is academic, but it is one of those natural happenings which developing techniques could transform into an item of great importance.

IT was almost 50 years ago that Heike Kamerlingh Onnes a Dutch investigator of the behaviour of matter at very low temperatures, passed an electric current through some frozen mercury and made a startling discovery.

He found that, at a few degrees from absolute zero, all resistance to the flow of the current disappeared.

Physicists today are still hunting for an explanation of this bizarre phenomenon of super-conductivity, which seems to contradict some or our basic ideas about nature. But though we do not understand it very well, we are beginning to learn enough about superconductivity to make use of it.

This article is a report of some recent work which suggests that it may be possible to make superconductors which can be used in electrical equipment held at low temperatures.

NORMAL CONDUCTION

Let us begin by considering the normal conduction of an electric current by a metal. We know that the current is transmitted by the motion of electrons driven through the metal's crystal lattices by the applied electric voltage. The electrons collide with the atoms in the lattice; this impedance of their motion constitutes the conductor's electrical resistance.

The resistance increases as the temperature increases, because the vibrating atoms in the lattice then oscillate over wider distances from their lattice positions and interfere with the electrons' motion more strongly.

Now it is reasonable to suppose that if the atoms' vibrations were completely stilled by reducing the temperatu absolute zero, resistance to the flow of electrons might to an undetectable level. But Kamerlingh Onnes found resistance vanished abruptly at several degrees above ze

Mercury became superconducting at 4.2 degrees vin certain other metals did so at different temperatur the low range down to around one degree — the l Kamerlingh Onnes could reach. Later the German phy W. Meissner, discovered another peculiar property of n in the superconducting state. They were impervious magnetic field; placed between the poles of a magnet, completely expelled the field, so that the lines of mag force went around the material.

About 20 years ago Fritz London, a German-born cist then working in England, suggested a theory abou behaviour of matter in the superconducting state. Sinc free movement of electrons through a superconducting is analogous to the unimpeded motion of electrons in orbits around the nucleus of an atom, London reasone an external magnetic field fails to penetrate a supercon ing material because it shifts the large "orbits" of the trons in the material so that they set up a counteracting netic field of their own.

London's concept gave an understandable picture, of course, it did not explain why a mass of materials s behave like a single giant atom — that is to say, why tion of the material to a very low temperature should unobstructed orbits for the flow of electrons.

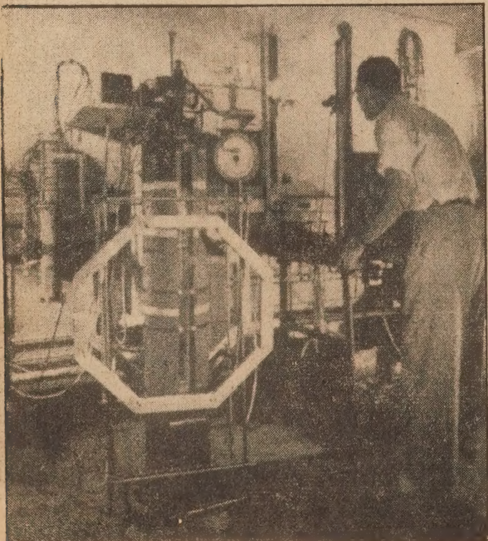
VIBRATING ATOMS

In 1950, H. Frohlich, at Purdue University, and Bardeen, of the Bell Telephone Laboratories, attemp more specific explanation. Their theory said that a temperatures the vibrating atoms in a crystal lattice no obstruct the flow of electrons, but on the contrary, abruptly to conduct this flow in a wave-like way; in words, the lattice vibration itself becomes the agen makes the metal superconducting.

According to the Heisenberg uncertainty principle quantum theory, the vibrations of atoms can never die entirely. Even at absolute zero the atoms in a lattice retain an irreducible motion, called "zero-point vibrati

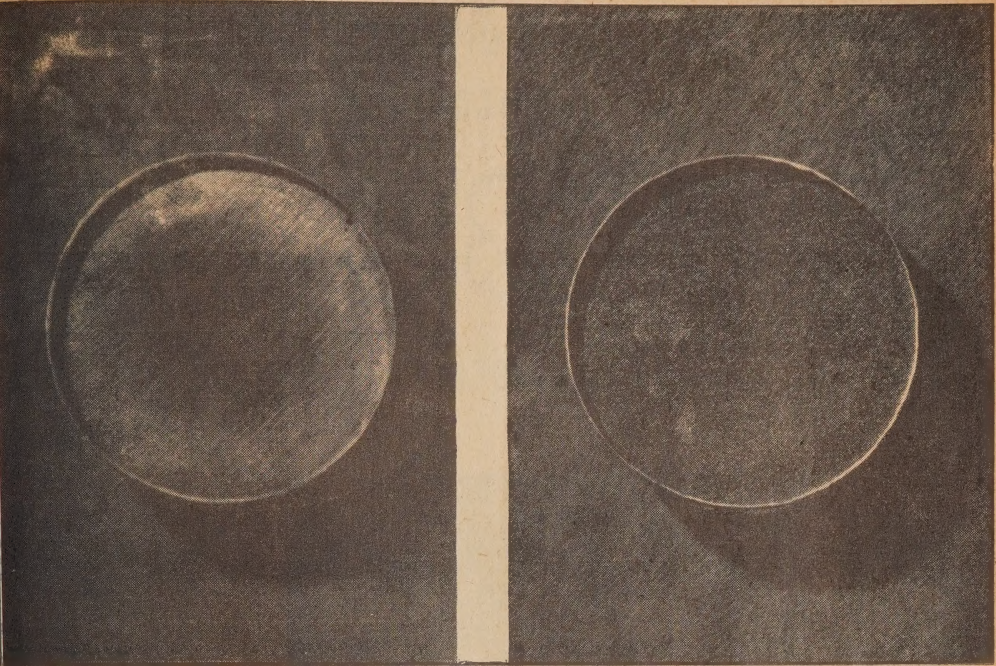
The Frohlich-Bardeen theory of superconductivity that, at very low temperatures, these vibrations of atom the motions of electrons are synchronised, so to spea a result of the interaction between the atoms and the trons, the electrons reduce their energy and ride alon the lattice vibration as on a wave. Thus resistance flow of electrons disappears.

The theory was suggested by the fact that metals are comparatively poor conductors at normal tempe are most apt to be superconductors at low temperatures. lich and Bardeen reasoned that since these metals strong scattering effect on electrons at elevated temper

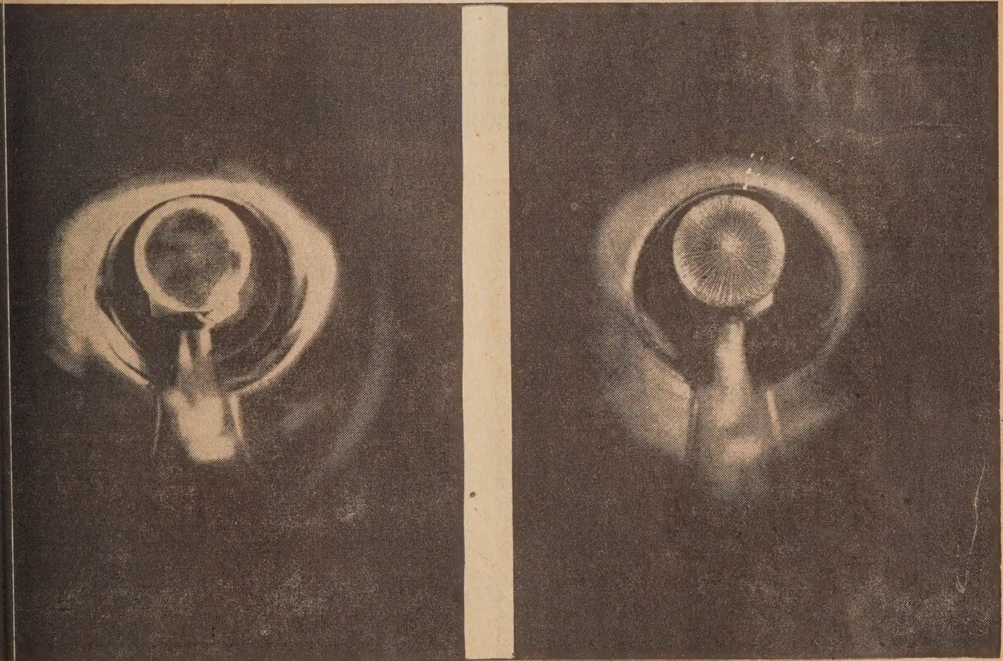


Effect of a magnetic field on superconducting metals is stu with this apparatus in the Bell Telephone Laboratories. A sa of superconducting metal is placed in liquid helium at the tom of the cylinder at left.

TREATMENT OF SAMPLES FOR SUPER-CONDUCTIVITY



Sample is prepared for an experiment with the apparatus on the opposite page. At left is a disc of very pure tin surrounded by a **low retaining wall made of paper. At right, the surface of the** disc has been covered with a powder of the element niobium.



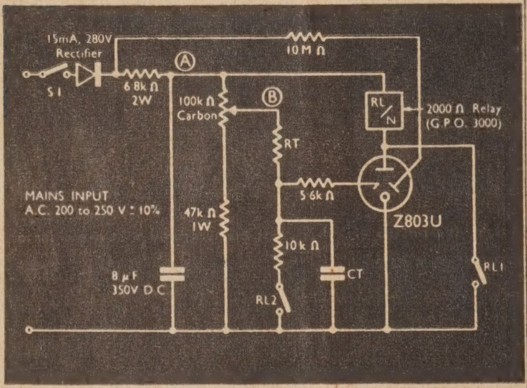
Sample is lowered into apparatus (left). Around it is the silvered wall of an insulating Dewar flask. After an electromagnet around the flask has been switched on, the particles of niobium move into superconducting and non-superconducting areas (right).

FOR TIMER SIMPLICITY AND ACCURACY

Z803U

TRIGGER TUBE

Mullard
Z803U



The Z803U trigger tube can be used for a variety of timer, voltage control and general relay applications. It has an extremely stable trigger voltage over a very long operating life and offers the advantages of all Mullard cold cathode tubes — no heater supply requirements, no waiting for "warming-up" and good mechanical strength.

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Typical of the applications of the Z803U is the simple interval timer described here which can cover the range between 5 seconds and 10 minutes. It may be operated direct from any a.c. mains supply between 200 and 250 volts.

To start a timing sequence the mains supply is switched on (S1). The d.c. voltage at point will then rise, in about 100 milliseconds, to between 184 and 282 volts, the actual level depending on the value of the local mains voltage. The timer capacitor CT will start to charge up through RT, the timer resistor.

When the voltage on CT reaches the critical trigger voltage of the Z803U the tube will fire, pulling in the relay, partially discharging the 8 microfarad smoothing capacitor, and lowering the voltage at A.

The relay will self lock on contact RL1 thus extinguishing the Z803U, and the relay current will then be limited by the 6.8 k Ω series resistor. Contact RL2, which should make after RL1, re-sets the timer capacitor to zero volts.

However, the relay drops out only when S1 is opened. A new sequence can then be started on reclosing S1.

The 100kΩ preset potentiometer allows the timing circuit voltage to be set up so as to compensate both for component tolerances and for the value of the local supply voltage. The pre-firing voltage at point B will be about 170 volts.

The values of RT and CT will be set by the required time interval T′, and can be determined from the fact that $T' = 1.6\ RT.CT$.

RT should be a high stability resistor, while CT must be a capacitor with a small power factor, e.g., a paper or plastic film capacitor. All other components are of ± 10% tolerance.

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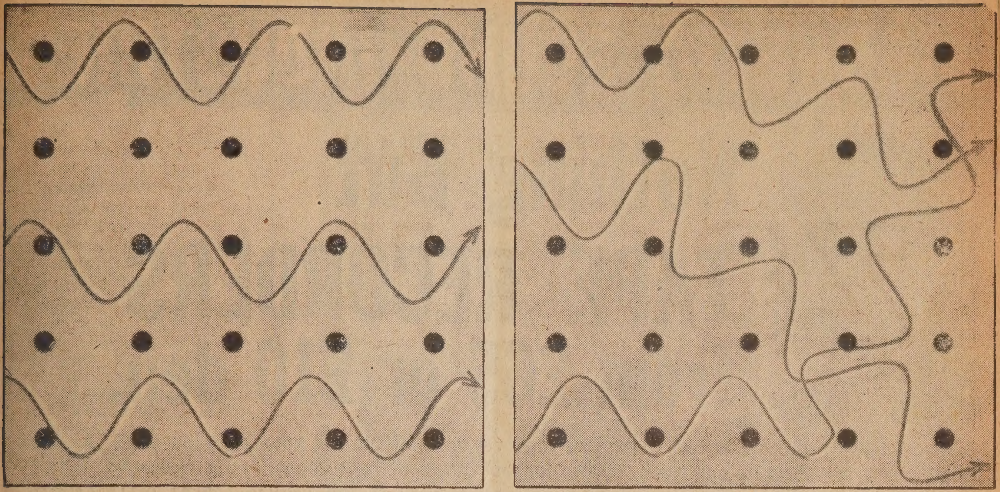
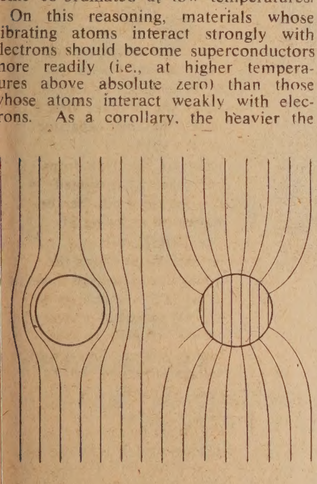


Superconducting electrons (wavy lines at left) interact in an orderly way with atoms (dot) in a crystal. Ordinary conducting electrons (right) are deflected by atoms.

hey should have a strong ordering effect n electrons when the vibrations of their toms and the motions of electrons beome co-ordinated at low temperatures.

On this reasoning, materials whose ibrating atoms interact strongly with lectrons should become superconductors nore readily (i.e., at higher temperaures above absolute zero) than those vhose atoms interact weakly with elecrons. As a corollary, the heavier the ement, the less likely it is to become superconductor, because its low-temerature vibrations will be comparavely slow.



Effect of superconductivity on a magnetic field is depicted in these schematic drawings. A sphere of ferromagnetic material (circle at left) concentrates the lines of force in a magnetic field. A sphere of superconducting material (circle at right) expels the field.

Frohlich predicted that light isotopes an element would become superonducting sooner (at higher temperares) than the heavier ones, and this oved to be true.

Recently Bardeen, Leon N. Cooper d J. Robert Schieffer at the University Illinois worked out a more complete new theory. It yields a correct description of properties of a superconductor, but there is still some question about the mathematical rigour of its treatment of the magnetic effect.

In 1950 John K. Hulm and I decided to try an entirely different approach. Since the theories offered no dependable means of predicting just what substances might be superconductors, or at what temperatures they would reach this state, we set out to find superconducting materials strictly by experiment.

Our hope was that after we had tested a large number of substances, we might begin to see a pattern which would identify some of the physical and chemical properties associated with superconductivity.

VALENCE ELECTRONS

Having almost no clues as to where to look, we tried one compound after another. At first we seemed to be getting nowhere. But after three years of testing a great number of compounds a crucial fact began to emerge.

It appeared that the decisive factor determining how readily a substance would become superconductive was the number of valence electrons possessed by its atoms—valence electrons being those in an outer unfilled shell.

We found that the only substances which became superconducting were elements or compounds with an average of between two and eight valence electrons per atom. And within this range the materials with an odd number of valence electrons per atom—three, five or seven—become superconducting most easily (furthest above absolute zero).

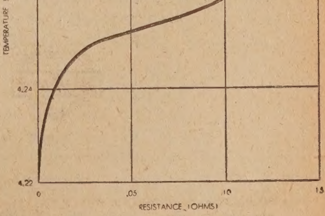
Here is the kind of rule we have been looking for. We now have a specific guide to finding or synthesising superconductors. We should seek substances with an average of three, five or seven valence electrons per atom.

To this rule we can add a few other helpful clues: it is known, for instance, that superconductivity is favoured by certain kinds of crystal structure and by the amount of empty space in the crystal (i.e., space not occupied by atoms).

With these empirical rules to steer us, we have been able to produce many superconducting materials. I shall illustrate with a few particularly striking examples.

The rare element technetium, found only as a product of uranium fission in atomic reactors, has seven valence electrons and a crystal structure favourable for superconductivity. John G. Daunt and James W. Cobble at Ohio State University had found that technetium does, in fact, become a superconductor at a relatively high temperature—11 degrees Kelvin.

Now the elements before and after technetium in the periodic table, are, respectively, molybdenum and ruthenium. Ruthenium, with eight valence electrons, has to be cooled to within half a degree above zero to become superconducting. Molybdenum, with six valence electrons, cannot be made super-conducting at all at the lowest at-



Electrical resistance of mercury is plotted against temperature. The resistance disappears entirely at about 4.2 degrees Kelvin (4.2 degrees centigrade above absolute zero).

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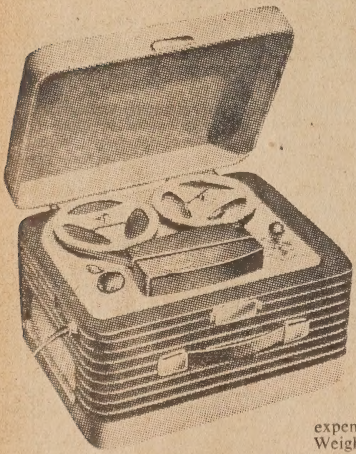

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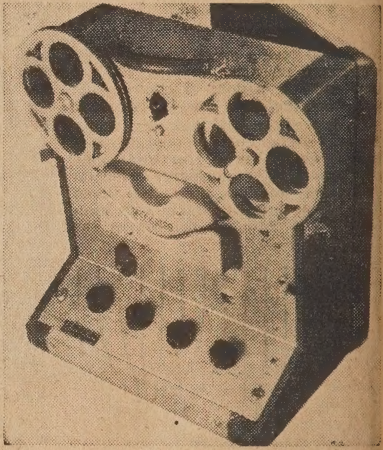

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STREET LEVEL, BISLEY HOUES, 387 GEORGE ST. PHONE BX4440 or BX4587 erconducting at all at the lowest at- able temperature (around one tenth one degree above absolute zero).

ut if we make an alloy composed equal parts of molybdenum and enium, so that the average number valence electrons per atom is seven the crystal structure is identical with of technetium, the combination be- ies superconducting at 10.6 degrees lmost exactly the same as tech- um's transition temperature!

Molybdenum can be made a super- ductor by dissolving in it a little dium, which has nine valence elec- is and therefore raises the average iber in the mixture to slightly more molybdenum's six. The same is of tungsten, which like molybde- has six valence electrons and will become superconducting alone. We e produced many different super- ductors by alloying molybdenum or gsten with other elements, such as umbium (niobium), phosphorus, an- ony or boron.

t is even possible to make a super- ductor by combining two elements ch by themselves are totally unfitted this property.

ECIAL SUPERCONDUCTOR

good example is the combination of on and cobalt. Silicon, of course, is a metal or a conductor of electricity. palt has two qualities which com- ely disqualify it for superconduc- y, it has nine valence electrons and strongly magnetic. Yet when silicon cobalt are combined in a cubic stal structure, they become a super- ductor, because the silicon neutralises alt's magnetism and reduces the aver- number of valence electrons per n to the appropriate range.

gain they can employ another type manipulator based on the fact that stal bulklines promote supercon- tivity. There is a compound of nickel arsenic which has a favourable crys- structure and a favourable valence- tron number, yet it fails to become erconductive as we would expect. at we did in this case was to replace the nickel with the bulkier atoms palladium, and this mixture then be- e a superconductor.

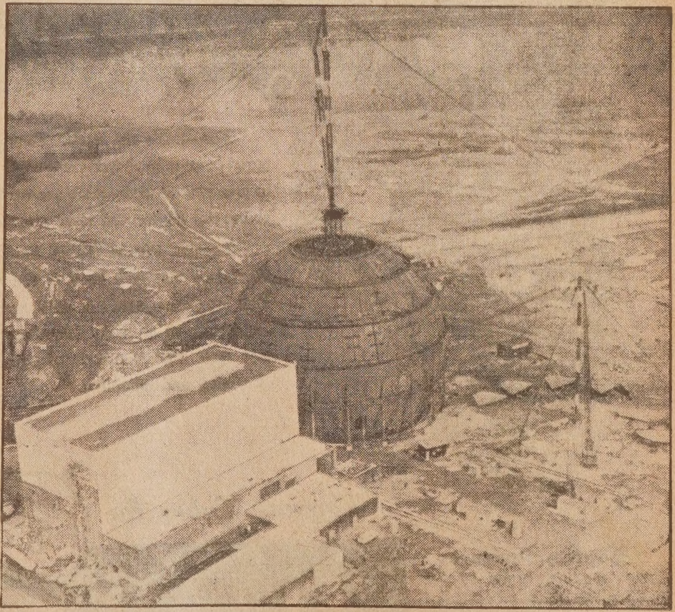
e found that the most favourable tal structure for superconductivity the one called the beta-tungsten cture—a cubic arrangement of eight ns which makes the crystal bulky, considerable space between some he atoms.

ompounds with this structure and a nce-electron average between 4.5 and per atom proved to be particularly osed to become superconducting. On basis we deduced that a compound n and columbium should reach the rconducting state at a comparatively temperature. It turned out that compound could be made and did act become a superconductor at tly above 18 degrees Kelvin — the est transition temperature yet found.

e can conceive of substances that have transition temperatures as as 30 degrees, but so far we have succeeded in making stable com- ds with the necessary specifications. all events, transition temperatures as 18 degrees already bring us into ge where we can begin to envision g superconductors to work in a icable way.

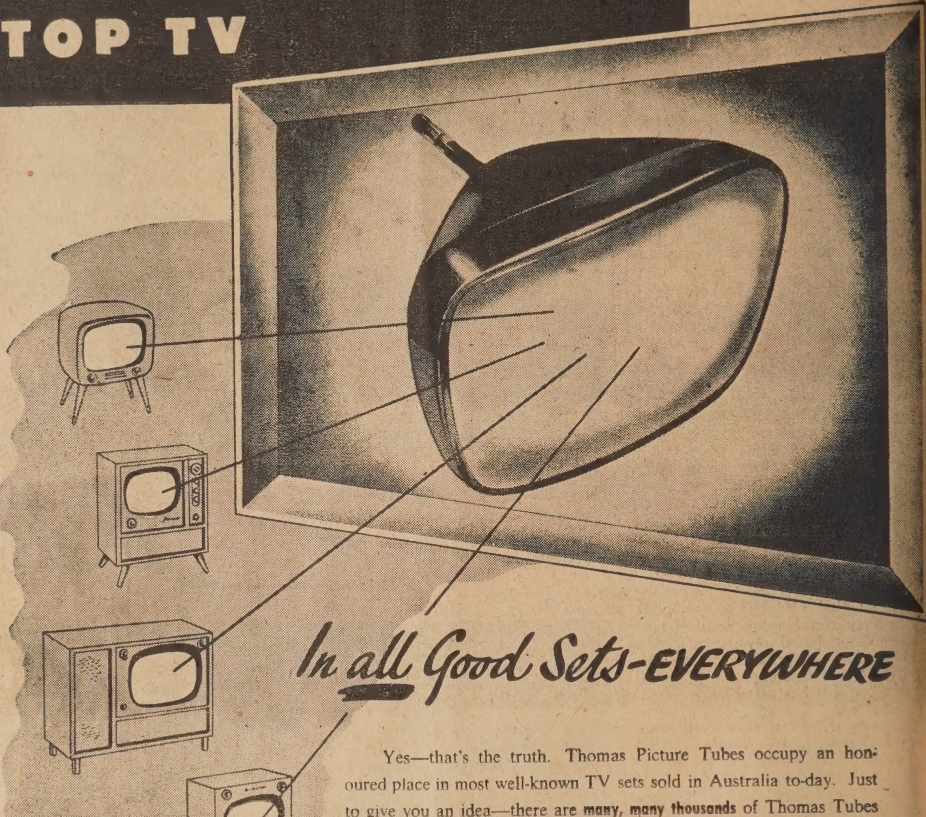
TV AIDS IN CANCER RESEARCH

Closed circuit television for cancer research and as a medium for general research in education was demonstrated recently at the Northern Polytechnic (London). An audience of about 45 scientists, doctors and educationists saw a new £1,000 ultra-violet television microscope demonstrated for the first time. An industrial camera projects the microscope image on the screen. Picture on the screen shows crystals of ammonium platino cyanide.



Nuclear power plant at Dresden U.S.A. takes shape on the Illinois waterway, 50 miles north-west of Chicago. The steel sphere, 190ft in diameter, will house the boiling water reactor assembly supplying power for the turbines. Scheduled for 1960, the plant will produce 180,000 Kilowatts—cost 45 million dollars.

The 'Picture' Tube for TOP TV



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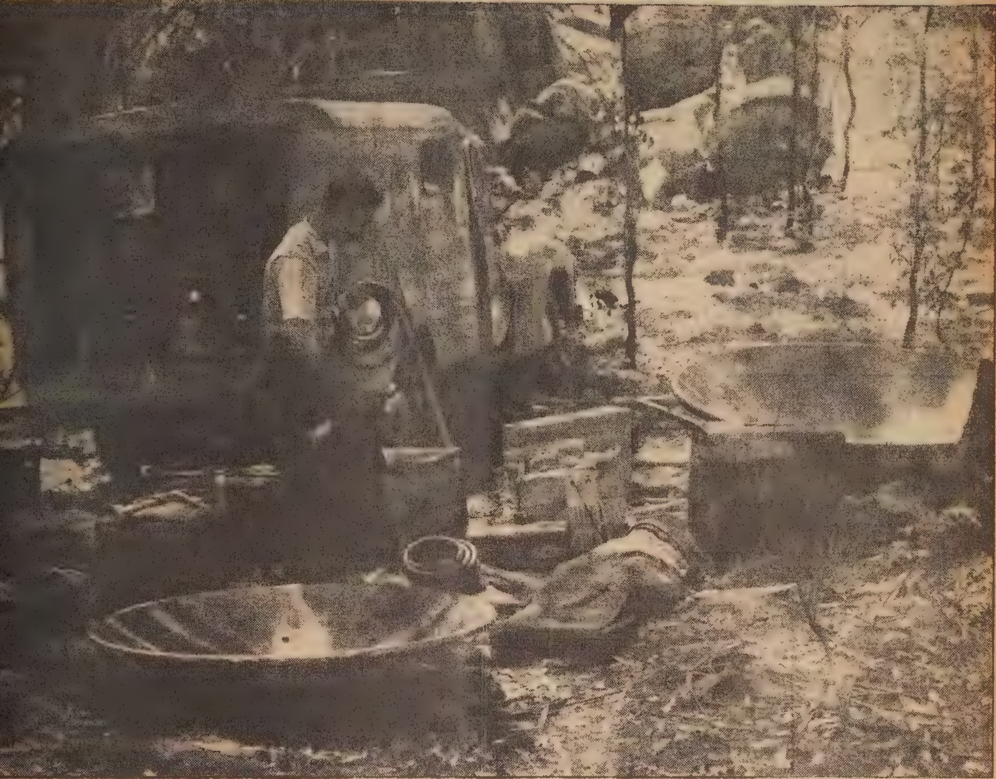
ATN's HISTORIC MICROWAVE LINK



his picture shows the installation at Repeater No. 1 (Mt. Gibraltar). In the back of the van is a motor-generator set for power. n the foreground are seen two of the microwave parabolic aerial reflectors, units of equipment ready to be unpacked, and connecting cables, All this was later manhandled to the elevated site.

Television station ATN in Sydney performed a remarkable feat on February 25 when it televised the visit of the Queen Mother to Canberra. It covered the inspection of Duntroon Military College in the morning, and the Ball at Government House in the evening. This was done by use of a micro-wave TV link operating over a total distance of 170 miles.

HIS is believed to be the longest TV
link ever attempted by a station
ng its own facilities.

ATN is a prolific user of these links.
ere is one permanently installed to
ry normal programs from the studios
Epping to the transmitter at Gore
l. The receipt of new link equip-
nt to supplement that already in use
ant that, for the occasion, ATN was
e to mount two repeater points in
lition to its normal OB van, and these
e used for the broadcast.

he first link was established on Mt.
raltar between Moss Vale and Mitta-
g—a well known high spot much
oured for many years by amateur
erimenters on VHF and used for
1.G. telephone link equipment.

he second repeater was installed on
top of a high mountain outside Can-
ra in such a position as to allow a clear path back to Gibraltar, and down to the valley in which Canberra lies.

The distance between the two repeater points was approximately 85 miles, and a further 20 miles carried the signals into Canberra.

The occasion was the result of much careful planning extending over several weeks. Because of the extremely long hops involved, an initial survey of the path was made, and the probable behaviour of the equipment calculated to ascertain whether sufficient signal strength would be forthcoming.

Later, field parties went out to verify these forecasts, and the results in practice were found to tally almost exactly, demonstrating that the telecast was quite practicable.

A pilot run made about a week before the event, ironed out initial problems.

Careful co-ordination was needed between technical crews and their equipment, for some of these were required at the weekend to cover a surf carnival on the Saturday and a visit of the Queen Mother to A.W.A.'s factory on the Monday.

Immediately this was over, the crews left for their distant position, and commenced setting up the gear for the big event.

The arrangement of the links was as follows: The OB van, a completely equipped TV station in a truck, was located at a selected spot at Duntroon, and later at Parliament House. It transmitted its signal to the repeater on the mountain outside Canberra, using a frequency of 6,800 megacycles. This was Repeater No. 2.

The equipment at this point received the van's transmissions and used them

BUILDING THE 35W. P.A. AMPLIFIER?

FEATURED IN LAST MONTH'S R. & H. p. 48

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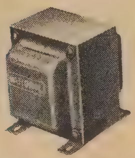
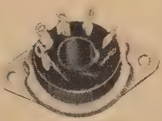
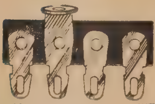
	3,900 ohms ½W	BTS	
	2,200 ohms ½W	BTS	
	100 ohms ½W	BTS	
	1.5 meg ½W	BTS	
	10,000 ohms ½W	BTS	
	82,000 ohms ½W	BTS	
	3,300 ohms ½W	BTS	
	1 meg 1W	BTA	
	100,000 ohms 1W	BTA	
	47,000 ohms 1W	BTA	
	220,000 ohms 1W	BTA	
W W RESISTORS 	I.R.C.	TYPE	
	5 Watt Wire Wound		
	1000 ohm Ctg "A"	AB	
	50 ohm 5 Watt Ctg "A" (Centre Tapped)	AB	
	125 ohm 20 Watt Ctg "B"	DG	
VOLUME CONTROL 	I.R.C.	TYPE	
	0.5 Meg. Single Carbon Control Standard (Silent Spiral)	CS	

COMPONENT	SPECIFICATION		QTY.
TRANSFORMER 	NATIONAL	TYPE	
	325V—325V	PA180/325	1
	6.3V 4A		
	6.3V 4A		
	5V 2A		
VALVE SOCKETS 	TELETRON	TYPE	
	Octal with mtg saddle	ST48L	1
	9-Pin with shield	ST59G/2	2
	9-Pin less shield	ST29G	1
STRIPS 	TELETRON	TYPE	
	4- Tag	SM24	1
	8- Tag	SM28	7
CAPACITATORS 	A.E.E.	TYPE	
	0.1 mfd 400 Volts	W48	1
	.047 mfd 400 Volts	W48	4
	.022 mfd 200 Volts	W99	2

Also components for the associated control unit.

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A close up of an aerial reflector at Mt. Gibraltar. John Innes is attaching the wave guide at the centre of the parabola. Radio waves emerging from the open end of the curved guide are ejected against the parabola which gathers them and radiates in a narrow "searchlight" beam.

to modulate a transmitter the output of which was beamed to Repeater No. 1 at Gibraltar on a frequency of 7,000 megacycles.

At Gibraltar, this process was repeated. and the final hop to the Epping studios was carried on a frequency of 7,100 megacycles.

After being absorbed into the normal equipment at Epping, the signals ravelled over a fourth path, the fixed ink used to carry programs from Epping o Gore Hill.

At the studios, the synchronising pulses received as part of the signals from Canberra were used to lock the synchronising generators at ATN, thus allowing all the normal telecasting faciliics of the station to be used.

The power used in these microwave inks is very small. They must depend or their operation on motor-driven generators which supply the necessary power. and because portability is largely dependant on size and weight, everyhing must be kept as small and as light as possible.

The radiated power of the link transmitters, therefore, is only 1 watt.

But the aerials used with them, beause of their high concentration of the adiated energy into a narrow beam, ffectively increase this power many imes.

For instance, the large "dishes" have gain of 11,000 times, so that the effecive radiated power is increased to 11 ilowatts.

The smaller dishes have a gain of ,000 times, which increases effective ower to 7 kilowatts.

The success of the venture was illusated by the excellence of the pictures ceived in Sydney, and made available both ABN and ATN because of the ational interest in the occasion.

During the telecast of the Duntroon eremony, the signals were noticed to ade out entirely for a few seconds everal times during the telecast.

Chief engineer of ATN, Mr Murray evenson, said that these fadeouts were ot due to atmospheric conditions, but reflections from aircraft flying in the cinity of Canberra.

Because of the very high frequencies volved, the metal skin of the aircraft ted as a very efficient reflector, and ere were times when the reflected signal ncelled out the direct broadcast from e OB van.

This phenomena is well known at these equencies and, of course, was outside e control of the engineers on the job.

In addition to the TV link itself, a HF telephone circuit was employed

(Continued on Page 77)

unit in the repeater link erected at epeater 2, somewhere outside Canberra. ere are seen the parabola and wave uide mounted on a tripod which lows the aerial to be aligned accutely to the next section of the link the OB van in Canberra. The RF ction of the equipment is mounted hind the parabola. Engineers are moving some trees which are obstructing the line of fire.

New Release

PUBLIC ADDRESS AMPLIFIERS

DUAL OPERATION mains or battery

The addition of two versatile mains and battery operated amplifiers to the extensive range of A.W.A. sound equipment provides for every requirement of mobile Public Address Operators.

Type PA828 amplifiers may be operated from 240 volt or 6 volt battery supply, changeover being effected by alternate cables which are stowed in rear of housing. A standby switch is provided to conserve battery life.

5 WATT AMPLIFIER

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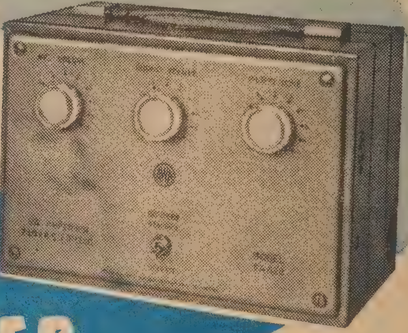
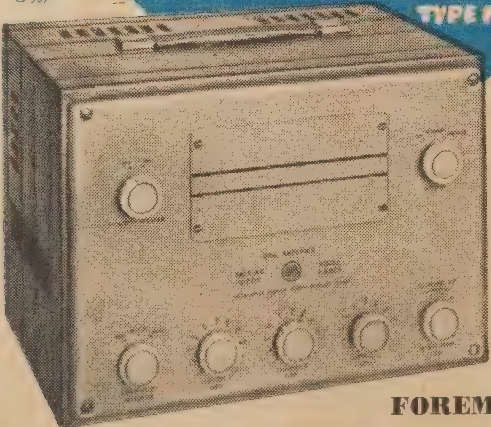


20 WATT AMPLIFIER

TYPE PA 829



Type PA829 20 watt mains or 12 volt battery amplifier provides all facilities necessary for P.A. Hiring

These include two microphone channels with third optional channel for microphone or pickup. Either high or low output pickups can be used. Features include a battery saving switch and a bass cut switch to control L.F. response when using horn speakers. A plug-in V.U. meter and monitor speaker with their associated switches are ancillary units.

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WHISTLERS MAY GUIDE SIGNALS

PHENOMENA OF IONOSPHERE MAY PROVIDE NEW PROPAGATION METHOD

The ionosphere is the home of many strange radio signals whose history is largely unknown. They range over a wide band of frequencies, some of them so low as to enter the spectrum generally asociated with audio. Gradually their nature is being unravelled by research workers.

THERE are signs that IGY scientists are investigating natural radio signals called "whistlers" may hand us a new, reliable, long-distance method of point-to-point radio communications.

By following the paths which guide whistlers on round trips through outer space, radio signals could avoid magnetic storms in the ionosphere.

NEW LIGHT

Whistlers were first detected 40 years ago and linked to lightning discharges 30 years ago. But until six years ago no basic understanding existed.

Dr. R. O. Storey postulated in 1952, at Cambridge University, that whistlers follow the earth's lines of magnetic force through ionised gases in the exosphere.

At that time there was no real proof that there is sufficient atmospheric density to support magneto-ionic ducts above the 250-mile ionospheric altitude range.

Subsequent investigations have borne out Storey's theories. Here is what is now known:

Ionized gases from the sun are formed into magneto-ionic ducts extending 500-30,000 miles up.

DUCT PATHS

These ducts run from a magnetic co-ordinate in one hemisphere to the comparable co-ordinate in the other hemisphere.

Whistlers bounce from hemisphere to hemisphere along one or more ducts at frequencies of 1,000 to 30,000 cycles. They are received simultaneously at points over 1,000 miles apart.

Whistler-mode propagation went beyond theory for the first time this summer when Stanford University successfully carried out a radio experiment.

A special pulse signal was sent from NSS (15.5 kc) at Annapolis to Cape Horn through the ionosphere and the exosphere. Both signals were received.

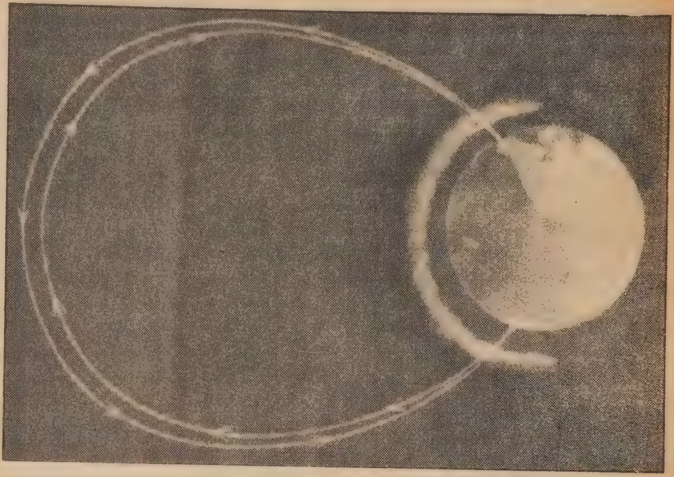


Diagram showing suspected "whistler" path as indicated by experiments at Stanford University.

The signals over the 20,000-mile whistler path took 0.7 second longer and were 10-30 decibels weaker, but the variations in amplitude appeared systematic.

There is reason to believe that whistler-mode signals from NSS may equal or exceed the direct wave in strength at points further south (of Cape Horn), according to R. I. Helliwell, of Stanford Radio Propagation Laboratory.

If this turns out to be true, the new mode would have distinct communication possibility. New recording stations are now in the process of being readied at points in Argentina, Chile and Antarctica.

PART OF IGY

These experiments are part of a broad investigation into whistlers as part of the IGY programme in ionospheric physics. Overall results, authorities feel, will be of value to the established radio communications systems.

Whistlers provide a probe into the exosphere. Hence, they furnish data on matter in space, solar storms, magnetic storms and fields and weather causes.

One result of the IGY programme may be a map of the magnetic influences surrounding the earth — a road map for future communications.

PROGRAMME WELL ADVANCED

There are 30 whistler stations in the IGY programme. Stanford and Dartmouth College are each administering about a dozen for the U.S. National Committee for IGY and cooperating countries.

Helliwell is directing "Whistlers West" and Millett G. Morgan, of Dartmouth, is directing "Whistlers East." Both schools have pre-IGY backgrounds in whistlers.

Whistlers can be received over telephone lines or a large antenna and an ordinary audio amplifier. IGY stations use a loop antenna and specially-designed wideband equipment to achieve analytical sensitivity.

Each station makes recordings at co-ordinated times to allow world-wide comparison of signals. During IGY's 18 months, over 3,000 miles of tape will be used.

NEW ELECTRONIC DEVICE RESTORES VISION

DEVELOPMENT of a device which "sees" through fog, rain or snow was announced recently by Diamond Antenna and Microwave Corporation of Wakefield, Mass.

"Eyetron" converts microwaves into visible light, reproducing the vision of the human eye electronically.

The company claims Eyetron will permit safe landing of planes under zero visibility conditions. Other applications, the firm says, include "close navigation" for ships and harbour craft.

Eyetron is not radar, nor is its purpose to replace radar. Its chief intention is to supply the 'missing link' of present-day radar systems; that is, to fill the gap where radar is useless at close proximities and where radar-type presentation requires skilled operators.

The company is withholding technical details of the device for military reasons.

Let's Look At Guided Missiles

☆

By CALVIN WALTERS

☆

Photograph just released shows for the first time the final stage rocket of the U.S. Army's Jupiter-C missile being assembled by technicians at Huntsville Alabama. The satellite is being lowered into place.

Most articles on guided missiles tend to become rather technical and specialized. This one reduces the subject to everyday language, and includes some interesting information on the histroy of missiles and rocket engines. Did you know that rockets were used at Waterloo?

WORK on guided missiles has now become a matter of the highest priority in all the major countries of the world. This is because it is realised that a guided missile is about the deadliest weapon of modern times.

Whilst it is true that the A-bomb and the H-bomb constitute the deadliest devices of destruction known to man they must be carried in some vehicle to the point where they are to be dropped.

Hitherto it has been the aeroplane which has been used for this purpose, and as the aeroplane must be manned by a crew, it is obvious that, as both man and machine are costly items to be expendable, any means of carrying and delivering the bomb without the aid of a pilot is the more satisfactory method.

A missile therefore which is guided to its destination from the ground and which can drop the bomb with accuracy is about the deadliest weapon which could be devised.

The race is on, then, for all kinds of weapons, from short and medium range missiles to the long range intercontinental ballistic types loaded with war head.

The guided missile is a rocket. Co trary to general opinion the rocket not a new weapon. It was used in Chir in the thirteenth century but not course as a guided missile.

In 1808 Sir William Congreve fir used iron war rockets which weigh about 24 pounds. These had thick ir heads and acted something like a sh from a cannon. They were fired fro a tube and steadied by means of stic attached to the sides. The fuel for the rockets consisted of saltpetre 68 par sulphur 12 parts and charcoal 32 par

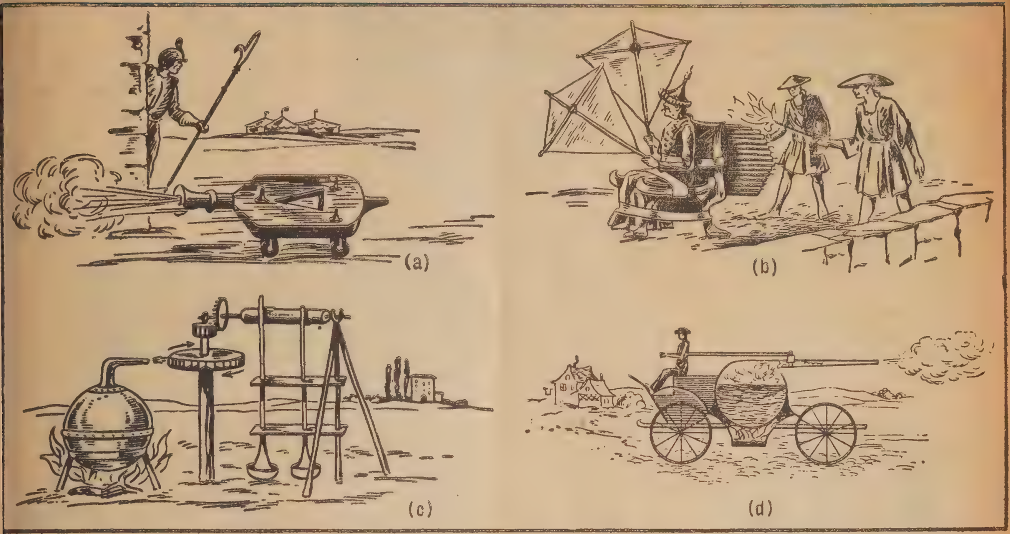
COMMENT FROM THE PAST

How far we have come from th days can be seen from the following tract from an old encyclopedia da 1888.

"In the more modern Hale rocke rotatory motion is given by caus the gas to pass out of vents in base, bored between three project shields, shaped something like the bla of a screw propeller against which presses. The cumbrous stick is th fore no longer used. . . .and the roc is fired from a trough to give it required range . . . . as much as 4, yards. Though extremely portable. rockets are so uncertain in their fl that they are not much used except incendiary purposes and against sava Against cavalry they would be useful if they could be depended up

Well! Well! They could be fired much as 4,000 yards but are more ful as incendiary weapons and aga savages. We have certainly come a l long way except that I doubt tha

ROCKET ENGINES HAVE AN ANCIENT HISTORY



"Rocket" motors of the past—(a) Rocket car designed by Jones de Fontana in the fifteenth century. (b) Chinese experimenter Wan Hoo risked his life in this flying machine which did not fly! (c) Giovanni Bronca invented this jet turbine in 1629. (d) Newton's wagon, driven by the reaction of a steamjet.

any respects we are the less savages r all that.

So much has been written about the eory of rocket propulsion that I will ly touch briefly upon it here in order refresh the memories.

It all has to do with Newton's Law action and reaction which states that r every action there is an equal and posite reaction.

This means that if you push against e table with a given force the table ll resist with the same force. Conrsely if you squirt water from the rear a cylinder with a given force there ll be the same force generated in e opposite direction, namely, to the ont.

CTION AND REACTION

So that if a fuel inside a steel cyliler generates gas and shoots the gas the rear there will be an equal thrust the front and the cylinder will shoot ward if the force is great enough. e recoil of a gun is another example this law as is also blowing up a balloon and letting it go without ng the nozzle. It will shoot all und the place.

Thus a missile is an enlarged edition a toy balloon with many notable imovements.

The missile takes the form of a steel inder provided with some sort of fuel her liquid or solid and some means guiding it to its destination but it is my intention here to enter into the ual construction of the missile.

Rather will we have a look at the mendous facilities which must be proved and the methods of testing miss for performance.

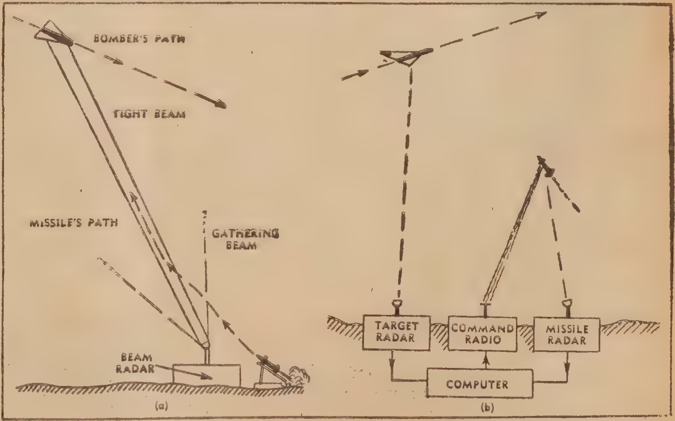
The testing of a missile is quite difent from the testing of an aeroplane. new type of aeroplane is a piloted machine which is tested by a pilot and observed by scientists from the ground. Thus when it has been air tested the required modifications can be made and the same machine taken into the air time after time.

Not so with a missile. By its very nature it is not recoverable to any practicable extent therefore all observations must be by instruments from the ground and signals from instruments enclosed within the missile itself.

Every time a modification is made a new missile must be built, which alone makes missile testing a most expensive business.

The advent of the wind tunnel reduced considerably the number of new missiles used for testing.

These tunnels, a few feet in diameter and may be 300 feet or so long are designed to duplicate the conditions which exist in the atmosphere during the flight of a missile. Air is driven into the end of the tunnel by means of turbines and the tunnel is provided



(a) Beam rider uses one radar tracker while the missile has sensing elements which enable it to fly up the beam to the target. A gathering beam is used to collect the missile after launching and to bring it into the tight controlling beam.

(b) The Command Guidance system uses two radar trackers, one to follow the target while the other follows the missile. A computer uses the data from the two tracking radars to issue instructions to the missile through a command link.

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In black or fawn portable case with detachable lid. Grey or gold, bronze deck and amplifier panel with black controls
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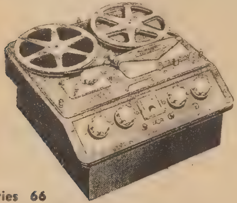
Including 7in reel of Ferrotape.



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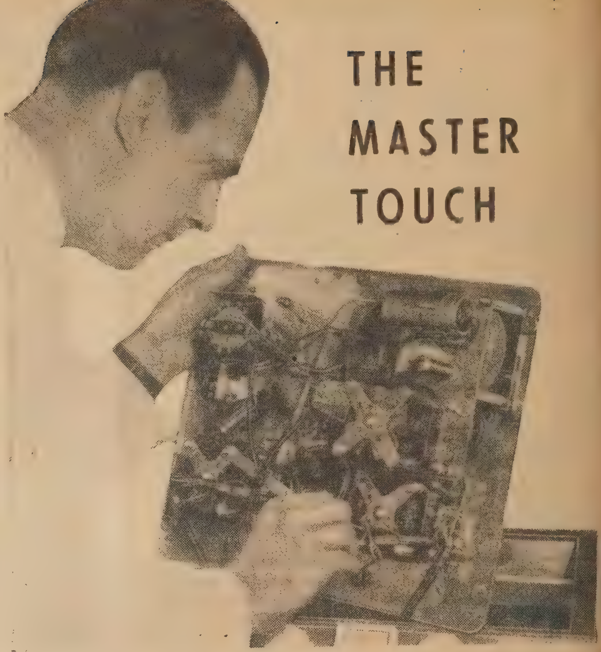
Note Both Models 77 and 88 require addition of external amplifiers and loudspeakers

THE MASTER TOUCH



IN THESE DAYS of impressive assembly lines—of ever-moving conveyor belts — of the advent of automation — it is well to remember that there are still products whose good name depends upon the traditional skill of the British craftsman.

Such a one is the Ferrograph — today freely acknowledged to be without equal in the field of magnetic tape recording.

In Australia, chosen by Government Departments, by the Services, by Broadcasting Stations, by Schools, by High Fidelity enthusiasts, by industry and research workers, by famous explorers and anthropologists whose sound recordings on tape are such an essential part of their work, by news commentators and those who travel the world to bring back recorded impressions, the Ferrograph owes much to those craftsmen who guard so zealously its unique reputation.

In the manufacture of a Ferrograph there is the closest control of every assembly operation. The tests to which every instrument is subjected are the most exacting that can be devised. Of course, such high standards of fidelity and performance cost money. But those who choose the Ferrograph are making a life-time purchase — they are the wise (and fortunate) ones to whom ultimate satisfaction and performance count so much more than initial cost.

THE INCOMPARABLE *Ferrograph*

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SYDNEY: United Radio Distributors Pty Ltd., 175 Phillip Street. Audio Engineers Pty. Ltd., 422 Kent Street. **MELBOURNE:** Simon Gray Pty. Ltd., 28 Elizabeth Street C1. **ADELAIDE:** Gerard Goodman Ltd, 192 Rundle Street **BRISBANE:** Chandlers Pty Ltd., Cnr. Albert & Charlotte Stree **PERTH:** Leroya Industries Pty. Ltd., 672 Hay Street.

with many different instruments for observing the behaviour of the missile in the tunnel.

Test models of a missile are fired into the tunnel with a gun. To test the distribution of pressure on the surface of the missile small bore tubing is connected from its missile to a mercury manometer. This is an instrument consisting of a tube filled with mercury. Pressure applied at the bottom of the ube will lift the mercury. The greater he pressure the higher the mercury will rise. A scale placed alongside the column is calibrated in pressure per square nch. It is like taking the blood pressure of the missile.

During flight the mercury levels are photographed to provide a record for comparison if modifications are made to he missile.

Then there is an instrument called a strain guage which is attached to the missile. These register by means of pen ecorders, the strains and stresses which are imposed on the body of the missile during flight.

SHOCK WAVES

In order to examine the behaviour of the air in the immediate vicinity of he missile, and the formations of shock waves and so on, use is made of shadowgraph apparatus.

If beams of parallel light are passed across the air stream the varying denity of the air caused by the entry of he missile will cast shadows on the beam. In practice, beams of parallel ight are directed across the air stream. This will throw a silhouette shadow of the missile as well as shadows representing the various graduations of pressures. These shadows are photographed for reference.

To study the problems of flight at extremely high altitudes and at high speeds, air under pressure is forced into the tunnel. This air must first be heated in order to avoid condensation at the high pressures required, and also to study the missiles heat transfer problems when entering the atmosphere at speed from great heights.

AIR TUNNELS

At one tunnel station air is contained in steel bottles which store 20,000 cubic feet of air at a pressure of 33 atmospheres. New types of devices heat this air to 540 degrees Centigrade before entry into the tunnel.

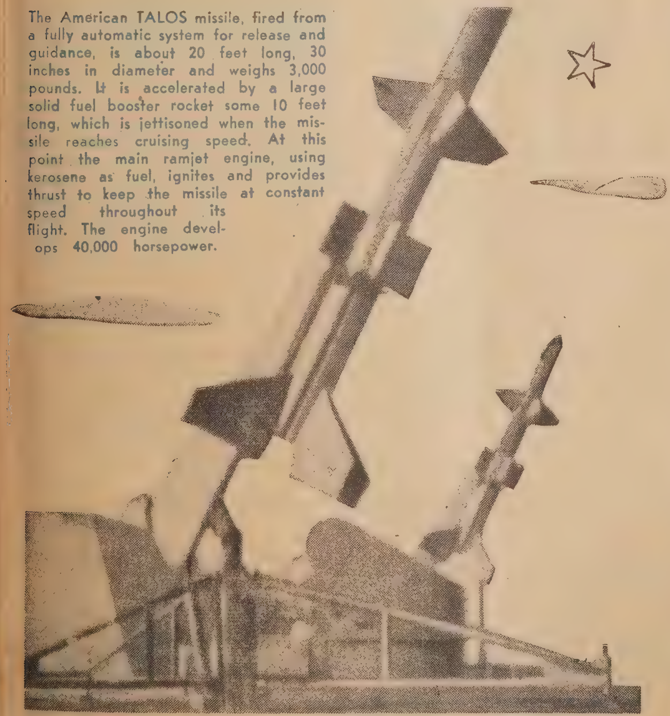
In this tunnel speeds of nine times that of sound are obtained and the missile can be tested in conditions simulating up to 200,000 feet of altitude.

Whatever is done in wind tunnels there comes a time when the missile must be finally tested in the outside atmosphere, and for this purpose a colossal amount of effort has been expended in various ways.

Testing grounds have been erected in various parts of the world, the longest land range ground being that at Woomera in Central Australia.

It stretches for 1,500 miles into the "Never Never" country, and is indeed a busy place with a township, a population of up to 5,000 people and some 500 houses.

We don't have much detail of our own Woomera testing ground but if it is anything like the American range at Cocoa in Florida it is a great venture indeed.



The American TALOS missile, fired from a fully automatic system for release and guidance, is about 20 feet long, 30 inches in diameter and weighs 3,000 pounds. It is accelerated by a large solid fuel booster rocket some 10 feet long, which is jettisoned when the missile reaches cruising speed. At this point the main ramjet engine, using kerosene as fuel, ignites and provides thrust to keep the missile at constant speed throughout its flight. The engine develops 40,000 horsepower.

This Florida range is 1,000 miles long extending over the Atlantic Ocean through a chain of observation stations on the Caribbean Islands.

More than 400 personnel stand by over these stations for each firing. These take care of the recording instruments at each station which are connected together by time signals from a master clock at a control base.

The launching base is at Cape Canaveral where a concrete block house is equipped with periscopes for observation of the missile during launching.

Radar equipment for tracking and searching is installed in a control building three miles away. Here, visual trackers trace the path of flight of the missile, and if the missile goes off course a safety officer can press a button and destroy it by radio.

FLIGHT RECORDING

From the time of launching, special cameras record the flight, and radar antennae located along the predetermined track of the missile over the islands keep it under observation.

Details relating to angles and speeds are given by optical instruments. These details are later used for the study of speed and the effectiveness of the guiding device.

The apparatus within the missile transmits signals giving certain information. These signals are recorded on tape recorders which are later decoded, and the resulting information used to determine what goes on inside and outside the missile.

Perhaps that which contains the most interest for the majority is the manner in which a missile is guided in its flight.

Generally speaking there are three phases in the guidance of the missile. Firstly there is the "launching phase" where it is controlled to prevent or correct any irregularity in its path, thus preparing it for its entry into the second phase called "mid-course guidance." This carries it to close proximity of the target where it next enters the "terminal guidance phase" to direct it straight to the target.

GROUND CONTROL

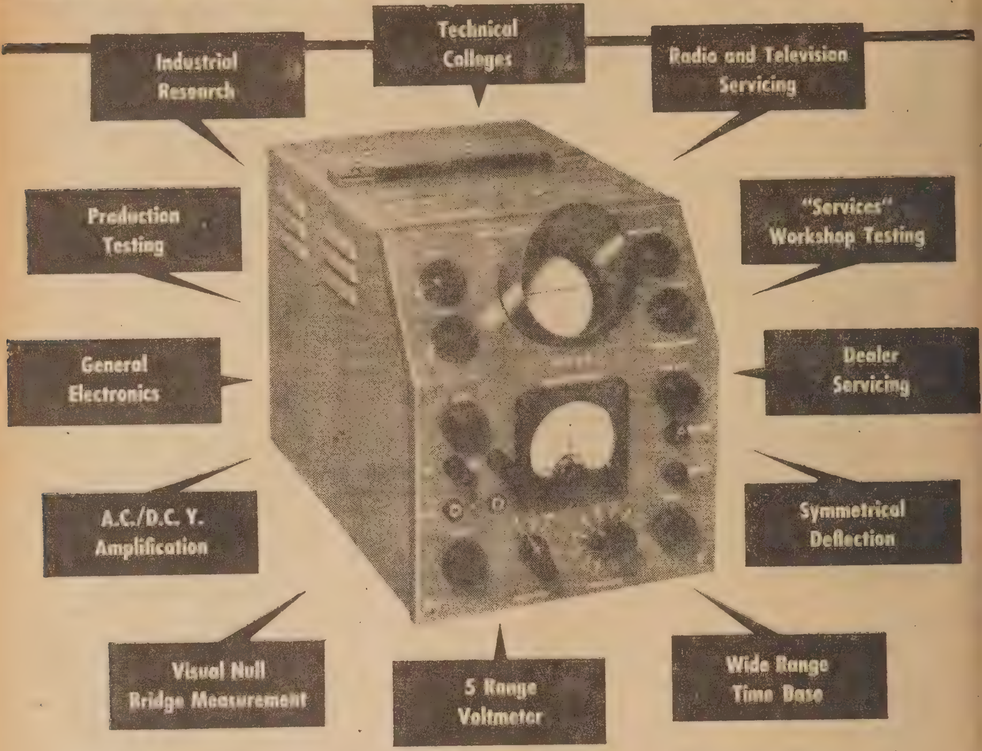
Whilst there is some difference in the guidance system between a missile directed from the ground to a stationery target and one directed to a moving target, we will deal only with the former as this will give a pretty good idea of the methods adopted.

Of course the missile must be provided with receiving apparatus to receive signals from radar transmitters located in the control room on the ground. These signals when received actuate relays and servo-mechanism devices which in turn actuate the steering apparatus.

At the "launching phase" the radar transmitters send out a beam with a conical form and another with a wider angle. The missile receiver is locked to the narrow beam but, immediately after launching it is gathered by the wide angle beam which directs it into the tight narrow beam where it is main-

(Continued on Page 63)

E·M·I MEASURING OSCILLOSCOPE TYPE W.M.S.



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★ **INPUTS**	**ATTENUATOR**	**INPUT R**	**INPUT C**
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D.C.	X2	2 "	65 " "
	X10	10 "	35 " "

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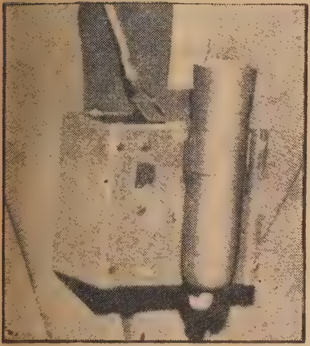
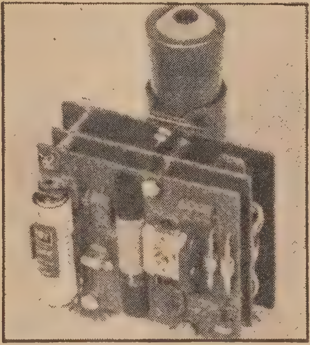
Technical Review

NOVEL WIRELESS MICROPHONE WORKS ON 460Kc



Wireless transmitter, worn as lapel microphone, permits announcer to move freely in studio or lecture hall. Transmitter operation is controlled by switch.



Interior view of transistorised microphone transmitter. Unit is compact and can be easily disassembled for repair through use of tier construction technique.

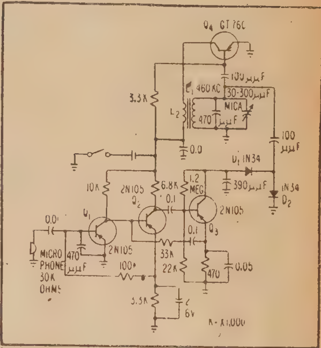


FIG 1—Circuit for wireless microphone transmitter. Operating at about 460 kc, transmitter radiates about .22 micro-microwatts directly from tank circuit.

An interesting application of transistors to a wireless microphone operating at a frequency of 460 Kc and an effective field too low to cause external interference. It establishes an induction field around the transmitter, and is received by a fixed FM superheterodyne receiver which recovers the audio signal and feeds a public address or speech amplifier. Peak deviation is about 10 Kc. (From Electronics).

WIRELESS microphones are useful in studio or lecture halls where the announcer or speaker must be able to move without being restricted by microphone cabling. The unit described here consists of a dynamic microphone with a self-contained wireless transmitter.

A fixed receiver, whose electrical output substitutes for the direct microphone output, is used to feed the public-address or speech pre-amplifier. Both the wireless microphone transmitter and the fixed receiver were originally developed for the main lecture auditorium at the National Bureau of Standards.

LIMITS OF TUBES

Wireless microphones commonly use vacuum-tube transmitters and usually operate on a frequency within the vhf band. Vacuum-tube power drain often limits transmitter battery life to several hours. In addition, a troublesome bar to vhf operation is the FCC requirement that the radiation from an unlicensed transmitter be limited to a very low figure.

For a moderate distance between transmitter and receiver, a signal with an adequate signal-to-noise ratio may be impossible to transmit without exceeding such limits. The transmitter described in this article uses transistors to permit relatively long battery life and operates at 460 kc, a frequency at which an induction field can be established around the transmitter within a usable area without exceeding the radiation field limitation.

The transmitter circuit diagram is shown in Fig. 1. Frequency modulation was chosen principally because of its inherent automatic-volume-control action. The transmitter radiates a signal directly from the tank circuit which consists of coil L1, wound on a ferrite rod.

The radiated power, determined by the transmitter coil current and its radiation resistance, is about .22 micro-microwatts. Power is delivered to the tank by Q4 operating as an oscillator at 460 kc.

Diodes D1 and D2 control the r-f current through a 100 pf capacitor shunted across the tank. The direct diode current through a 100 pf capacitor shun quency current delivered to Q3. A change in this direct current produces an approximately linear change in tank-circuit susceptance. The oscillator is therefore frequency modulated by the audio signal. Transistors Q1 and Q2 are audio-frequency amplifiers for the microphone output.

The coupling components were chosen to attenuate voice frequencies below about 700 cps. With the circuit shown, a normal speaking voice produces a peak deviation of about 10 kc. The total battery drain is about 15 milliamperes, so that with the single mercury cell the battery life is about 150 hours.

RECEIVER

The vacuum-tube superheterodyne receiver is shown in Fig. 2. An r-f amplifier, V1, operates at the signal frequency of 460 kc. Pentagrid converter, V2, converts the signal frequency to 50 kc and the signal is amplified and limited by V3 and V4.

The output of stage V4, a variable frequency square wave, is differentiated and rectified by the counting-detector diode D2. The audio signal is recovered by passing the diode output through a low-pass filter and amplified by V5. Peak audio output is about 0.5 volt.

Squelch action is provided by diode D1 which rectifies the received signal and unblocks the audio output stage during operation. This feature is useful in urban locations where the noise level is usually high.

The f-m superheterodyne receiver consumes little power and uses low plate and screen voltages consequently the operating temperature is low and the com-

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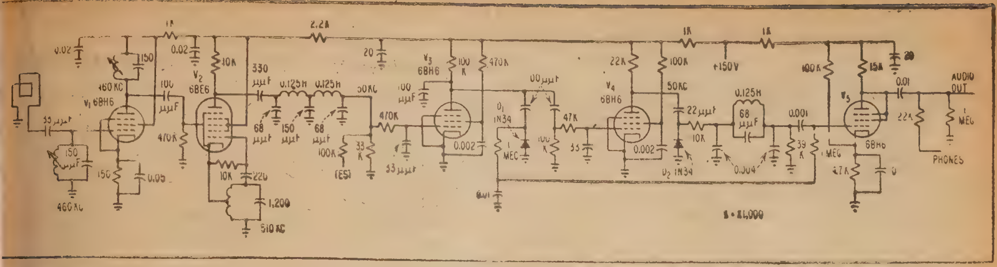


FIG. 2—Circuit for fixed receiver. Operating frequency of transmitter is converted to 50 kc by V2 and is amplified and limited by V3 and V4. Audio signal is recovered after passing through low-pass filter. Peak audio output of receiver is about 0.5 volt.

nents should have long life.

The overall audio-frequency response the system from microphone input the receiver output is shown graphically in Fig. 3. No audio-gain control s been included in the transmitter it a control may be desirable to keep deviation at maximum to compente for differences in speakers.

The maximum size of the receiving op depends on local noise field. A loop metres square was used for this equipent. The loop could be made larger using more transmitter power or by ducing local noise such as that genated by electrical machinery.

ERIALS

In noisy locations, it is helpful to a shielded receiving loop made of all coaxial cable. One end of the er conductor is connected to the unounded receiver antenna terminal, the er end of the inner conductor and shield braid are connected to the ound terminal. At a point halfway ound the loop, the outer braid is cut d stripped for a length of an inch two. Shielding is effective in reducing ctrostatic pickup from nearby noise urces.

ORTABLE TV RECEIVER

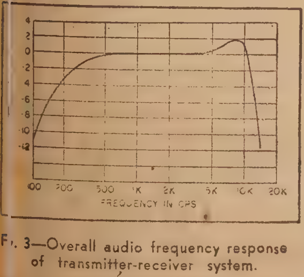
A portable 14in picture tube, cordless , powered by two 12 volt nickeldmium rechargeable batteries, was rently exhibited in Chicago by Motor, Inc. The unit has 31 transistors d utilises 10 watt power consumption. Battery life is six hours. A monopole ft antenna is used.

Motorola says "the unit is not a labatory freak. We can start building em right away if the economics make feasible. We want to encourage comnent manufacturers to get behind s."

As yet, it is too costly to produce. eight of the entire unit with batteries 32lbs. Unit takes 17 seconds for warm time. Excessive power in some portns of the TV receiver have been eliminated by a "scan-magnifier," a Motorola invention kept under wraps.

Price of the unit was not disclosed. The unit will play in a plane, train, etc. Batteries will withstand 2,000 separate recharges for an estimated 12,000 hours of life. Estimated cost of operation of the TV is 4/10 of 1 cent per hour.

A 90 degree tube is used. No printed circuits are used at the moment.



F. 3—Overall audio frequency response of transmitter-receiver system.

RADIO THERMOMETER FITS PENGUIN EGG

The unit uses a transistor oscillator powered by three mercury cells, and operates continually for 150 hours.

RECENTLY developed components have made possible a radio thermometer with far-reaching possibilities. Immediate application is to monitor the temperature at which the penguin keeps its eggs.

The purpose of the penguin experiments is to look for some of the reasons that make it possible for some forms of animal life to withstand extreme cold. Other forms, anatomically similar, perish under similar conditions.

A little deception of the penguins is required. The egg is opened and its contents removed. The radio thermometer and gelatin is substituted. The egg is resealed and returned to the unsuspecting penguin.

INDUCTIVE PICKUP

The radio was developed by American Electronic Laboratories for the Office of Naval Research. As well as size limitations the device had to be wireless, since penguins are inclined to carry their eggs from place to place.

Inductive pickup was used rather than conventional radiated RF energy. The salt water or flesh surrounding the egg would tend to absorb RF. In addition, designing an antenna that would fit in a penguin egg posed problems.

The unit uses a transistor oscillator powered by three mercury cells. It is said to operate continuously for 150 hours.

The use of a transistor was a natural. It is not only small, light and economical of power, but does not generate heat. In addition, being a current device, it is suitable for supplying current for the coil.

The radio thermometer has a range of 80 feet, is accurate to within 0.2 deg. F and weighs only 80 grams.

Another application of the thermometer is to test the effectiveness of survival suits. First reports from the Antarctic on these tests indicate that a man swimming in water at 25.8 deg. F increases his body temperature to 98.9 deg. F while actively swimming for the first 12 minutes. After that, while resting, his temperature decreases at the rate of about 0.3 deg. F every two minutes. The experiments last 20 minutes.

Other planned uses for the radio thermometer include studies of chickens and reindeer.

COLD LIGHT FOR FILMS

COMMERCIALLY made "cold" mirrors which reflect visible light and transmit heat rays have recently been tested in London. They are intended for use with cinema projectors in order to increase the light passing through the film without increasing the amount of heat.

The cold mirror depends for its results on an extension of the principle used in "blooming" lenses to reduce reflections from the front surfaces. To make a selective mirror a large number of coating alternately of high and low refractive index are used. The coatings slow down the light passings through them by approximately a quarter of a wavelength.

The different layers are of different thicknesses and one of the most tricky problems is calculating the exact thicknesses required to allow all the visible light but none of the heat to pass through or vice versa.

Apart from this there is the manufacturing difficulty of superimposing a large number of thin films, each of which must be accurately prepared to the thickness required. Deposition of the layers is carried out by evaporation in a vacuum. This multi-layered sandwich must be sufficiently robust and able to stand local heating if it is to be used close to an arc lamp.

With fifteen pairs of coating 98 per cent of visible light is reflected. Most of the heat passes through the mirror.

The mirrors have such a hard surface that they are not subject to damage from the splutter from projection arcs. As the "silvering" is on the front surface special heat resisting glasses which are not available in optical quality can be used.

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Q plus type VTT/1 10 channel turret tuner featuring low noise "Cascode," R.F. amplifier and high mu mixer oscillator. Special moulded coil formers prevent cores from coming loose. Special "alkyd" low loss high stability plastic used on all coil biscuits and mouldings. Oscillator is compensated for frequency drift due to variations in temperature. This unit comes fully tested and pre-aligned.

Video and Sound I.F. Channel (4-6CB6, 2-6AL5, 1-6AU6)

The ever popular Mark III I.F. strip, four stages of video amplification using bifilor and an over-coupled stage. Video detector, with R.F. filter and video detector load, intercarrier taken from video detector. Sound amplifier limiter stage and ratio detector, fully tested and aligned

Audio Amplifier and Output (6AV6, 6AQ5)

A triode voltage amplifier with beam tetrode power output. Negative feedback is applied to the 6AQ5. F.M. de-emphasis is obtained by a simple R/C network. Frequency response 90 c/s—5Kc/s at—6 db.

Video Amplifier (12BY7)

A high gain pentode using a combination of series and shunt peaking. Video detector is directly coupled to video amplifier grid. Output is capacitively coupled to picture tube cathode. The gain (contrast) is controlled by a cathode potentiometer. Frequency response up to 4Mc/s at — 6db., and greater than — 40 db., at 5.5 Mc/s.

Sync. Separator, Sync Phase Inverter (12AU7)

Sync pulses are obtained from the output of the video amplifier and applied to the sync clipper which removes most of the video content, and provides a substantial degree of noise immunity

Frame Oscillator and Frame Output (12BH7).

A frame blocking oscillator is used. The frame output stage drives the deflector using an auto-transformer to match the output to the yoke impedance

Line A.F.C./Line Blocking Oscillator (6SN7GTA)

The line A.F.C. is a D.C. control valve to correct the line blocking oscillator which used a "sine wave" stabilising coil. Small changes in sync control are obtainable by a pot. on the D.C. control valve. Once aligned correctly, this circuit will remain in sync. over long periods, with varying signal strength and mains variation.

Line Output, E.H.T. Supply (6BQ6-GTB, 6B3-GT, 6AX4-GT)

The line output/E.H.T. transformer (Q Plus VHOPT/1) (auto-transformer type) and the E.H.T. rectifier are shielded in a metal case and cover. Provision is made to alter this section for higher ultor voltage and drive suitable for a 90 degree 21in. picture tube

A.G.C.

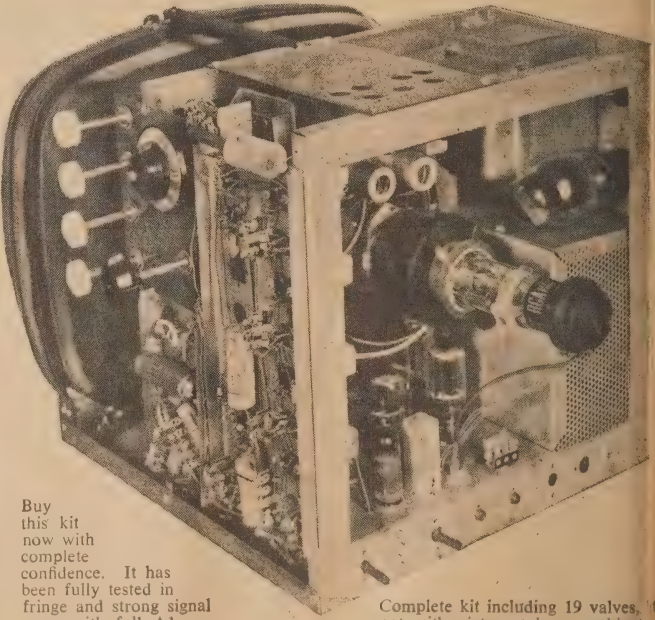
"Simple" type, supplied from video detector output. An area control is provided which uses part of the negative input to the line output grid. This negative voltage is filtered and applied via a potentiometer ("area" control) and the Tuner A.G.C.

Chassis

The main chassis comes pre-assembled, ready to take the power supply, line output/E.H.T. cage, tuner, video and sound I.F. channel, frame oscillator and output sub-chassis. The picture tube mounting, strap, etc., are screwed to the main chassis, making it one complete unit.

Controls

Channel selector and fine tuning are a dual concentric knob, volume off-on, brightness, contrast, frame hold, line hold, controls are grouped together and fitted with smaller knobs. Area (A.G.C.), frame height, frame linearity, line drive, line oscillator, line sine wave, line width controls are mounted on the rear of the main chassis. All these controls can be adjusted without removing the back of the cabinet.



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INDUCTION PICKUP FOR DRIVE-INS

Induction pickup methods seem to be gaining ground in many fields where lead connections are a problem. Here is a novel use for the idea which has been used successfully in U.S.A.

REPRESENTING a completely new technique in drive-in theatres, the Dover (N. J.) drive-in will be equipped with portable transistor-amplifier car speakers instead of the conventional type. It constitutes what its builders hope will prove the first of a great many such transistorised drive-ins.

The Dover drive-in uses conventional electronic equipment up to the output of its power amplifier. From there on, the wiring of the area and the loudspeakers used by the patrons are altogether different.

The theatre is unique. It has no loudspeaker posts—although, of course, it has speakers. It is not located far out in the countryside, but within the shopping centre of a city of 11,000. It is located on the top deck of the shopping centre's 2-level, 1,200-car parking lot.

As this deck is used for parking during daylight shopping hours, conventional drive-in speaker posts would be objectionable. Hence the new technique in which sound is supplied to patrons, not over the usual wires, but by way of an audio-frequency magnetic field.

Underground wiring suffuses the area with this field, which corresponds to the sound to be reproduced. It can be picked up anywhere in the area by an instrument consisting of a magnetic pickup coil, a four-stage transistor audio amplifier, and a 5-inch loudspeaker.

The basic idea of using an audio-frequency field instead of wires to convey speech and music to theatre patrons is not new. It was introduced roughly 10 years ago in indoor theatres, to energise earphones which theatres loaned to hard-of-hearing.

NO WIRES

In the magnetic-field system there are no connecting wires between the output of the amplifier and the speakers. A length of No. 12 wire is connected to the amplifier's output and laid about the grounds in a definite pattern.

The pattern consists of a number of loops of wire. Each loop is about 40 feet long and 15 feet wide. These loops are laid side to side and end to end in sufficient numbers to cover the area completely.

Electrically they constitute a series circuit, presenting a total af impedance of between 4 and 6 ohms, looking out from the amplifier terminals.

On entering the theatre, the patron is handed a speaker unit (approximately the size, shape and weight of a conventional drive-in speaker, but containing a pickup coil and encapsulated transistor amplifier, in addition to the speaker itself).

This he places anywhere in his car to suit his convenience. Windows can be kept completely closed. On leaving, he will be stopped at the exit and the speaker unit collected.

WILL NEED MORE SERVICING

The new speakers will need more servicing than the conventional kind. There are three reasons for this.

First, the transistor amplifier needs a battery. The condition of these batteries must be checked from time to time, and replacements made as necessary. Second, the new units are composed of a greater number of components—a greater number of things that may go wrong.

Finally, the new units are more exposed to physical injury. The conventional speaker gets some protection as it is fastened to a cord. If dropped, it may not reach the car floor or the ground.

If it is connected by a coiled cord; that acts as a tension spring and checks the force of a fall. The induction speaker-amplifier is not attached to anything. It is apt to be laid loose on the front or rear shelf of the car and may slide off or be jarred off.

Vido-Sound Corp., New York City, is the inventor and proprietor of the inductive sound distribution system. Although the basic principle of inductive distribution is not new, its current application is said to incorporate some patentable features.

ADVANTAGES

Vido-Sound claims the following advantages for its system:

1. Lower cost. They figure the cost of equipment, including wiring, at £25 per car, which they state is less than the average cost of conventional drive-in systems. The latter cost is estimated at £30 per car. Experienced drive-in engineers are not in complete agreement.

Vido-Sound claims as a further economy that less-expensive amplifiers can be used in the projection room. With this system a 75-watt output is adequate for 600 cars. The conventional requirement would be about 300 watts of audio.

2. Less maintenance. The Vido-Sound amplifier is a four-stage, printed-circuit, p-n-p transistor unit. Its gain is 37 db and the unit is encapsulated. This protected assembly rests in a chassis of silica gel. It uses a 9-volt battery, which has an estimated useful service life of six months to one year, and will cost the theatre 49 cents. 5-inch speaker completes the unit.

As already noted, this assembly obviously needs more servicing than a conventional unit, which consists only of a speaker, volume control and case. But, in conventional installations, not only the speakers, but the speaker boxes, transformers and connections need some maintenance.

3. Increased refreshment sales. The inductive speakers promote refreshment sales, since patrons can take them right along to the refreshment counter. They need not hesitate to go for refreshments out of fear of losing part of the show.

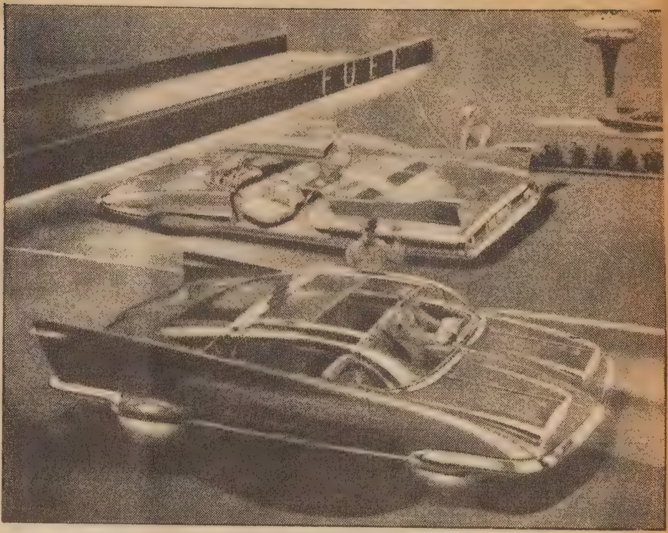
4. Less speaker theft. In the ordinary arrangements used by conventional drive-ins no excuse exists for stopping an outgoing car and asking for the return of a speaker. The speaker is supposed to have been left back at the post.

5. Fewer accidents. Speaker-post accidents cannot occur—there are none. Patrons walking from their cars to the refreshment area or rest rooms cannot be caught by or trip over speaker wires.

Engineers who do not favour the induction process look forward to possible drawbacks of one kind or another. They expect noise from car ignition systems, from sign flashers and from refreshment room machinery such as refrigerators. They suspect the steel underbody of the automobile may in some cases shield the transmission.

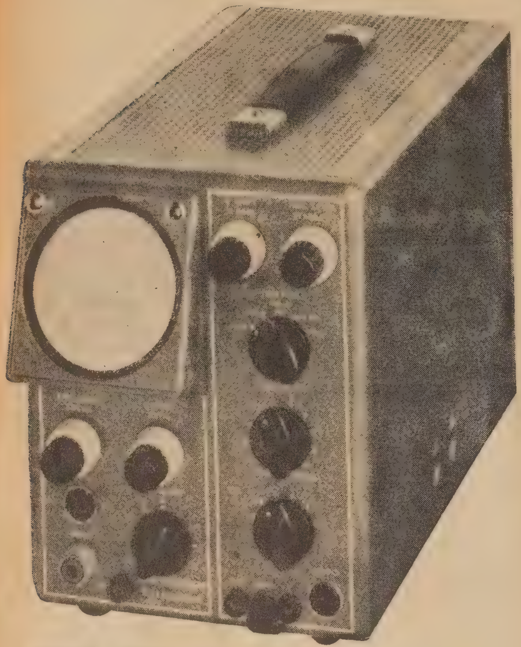
(Continued on page 127)

WHEEL-LESS CAR OF THE FUTURE



Detroit designer, Carl Reynolds, predicts this car of the future will have no wheels. It will be propelled by ducted fans, and travel two feet above the roadway. Small, light-weight engines are required. Target date—1978.

THE SERVISCOPE



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Rise Time.	.06u/sec (less than 2 per cent overshoot).
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9-position frequency compensated, direct reading in Volts/cm.
100 mV, 200 mV, 500 mV, 1V, 2V, 5V, 10V, 20V, 50V/cm.
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Voltage Measuring Accuracy plus/minus 5%

TRIGGERING.
automatic for repetitive signals up to about 1 Mc/s.

TRIGGER LEVEL CONTROL selects any point on input signal slope for repetitive, random, or single shot triggering.

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VOLTAGE CALIBRATOR. Stabilized 1 v.p.p. 50 c/s square-wave for checking voltage accuracy.

TIME BASE. 18 preset calibrated Sweep Speeds.
500, 200, 100, 50, 20, 10, 5, 2, 1 milliseconds per cm. } at minimum
500, 200, 100, 50, 20, 10, 5, 2, 1 microseconds per cm. } X expansion.
Slower speeds can be obtained by internal adjustment.
Time measurement Accuracy plus/minus 10%

X EXPANSION. Continuously variable up to over 10 screen diameters (50 cms.). Trace expands symmetrically about centre of screen. X-shift control positions any portion of expanded trace on screen. Direct Access to X-amp.

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Machine Identifies Numbers as They are Written

This amazing machine can be used to read numbers automatically as they are written, and thus to operate teletypewriters, recording machines, etc. for computer processing. The principle is capable of further expansion to save time in accounting procedure.

HANDWRITTEN numbers can be identified by a device about the size f a portable typewriter. With modifiations. the equipment can be made to ead handwritten letters as they are beng written.

The system has just been announced y Bell Labs and is expected to be a oon in the processing of the paper work or about two billion long-distance telehone calls a year. Bell thinks it may nd applications wherever it is necessary o write and identify large quantities of umbers.

SIZE RESTRICTION

In order that written numerals may e read with a minimum possibility of rror, mild restrictions must be placed n their size and form.

The constraints consist of two verticlly aligned dots, around which the umerals must be formed. Three radius ectors extend out from each of these ots, a seventh joins the two.

Numerals are then sensed by deterining which of these radius vectors re crossed.

Information as to which vectors have een crossed is transmitted to a transator, which contains transistorised logic ircuits.

Since each numeral has a correspondng set of crossings which is unique, the ranslator needs only to be able to disnguish each of the sets in order to roduce a different output for each umeral.

The outputs are employed in the utiliation circuit to illuminate a number, perate a teletypewriter, feed the inforation to a computer or perform any ther desired operation.

PECIAL PLATE

To recognise written numerals, a pecially prepared plate is employed on hich each radius vector appears as a losely spaced, insulated parallel set of onductors.

The numerals must be written with conductive pencil on a sheet of paper r a card. When this writing is supernposed on the printed plate and roperly oriented, the appropriate sets of onductors are shorted out.

To recognise numerals as they are beg written, a writing surface is proded on which there are two guide ots and in which seven radius vectors ade of conducting material. are emedded in plastic. The writing is done with a metal stylus on the writing sur face.

Hand-written reader can operate other data-processing gear.

Whenever a conductor is crossed, the information is fed to the translator and logic circuit.

As necessary crossings are made for a particular numeral, the translator again sends the proper information to the utilisation circuit. To clear the system for the start of the next numeral, a conducting plate is touched by the stylus.

BIG INCREASE IN U.S. TUBE SALES

THE sale of radio valves and picture tubes in the U.S.A. is certain to rise very considerably during 1958. according to report from Sylvania.

The replacement radio and TV parts segment of the industry continues to expand while the sale of television sets is down for the third straight year. Consumer buying is slowing. Fewer people will be spending for a new TV set during 1958 but everyone who owns a TV set will want to make sure it's in top working order.

Market research experts tell us more receiving valves and picture tubes will be sold this year than during the 1957 sales year

DROP FOR 1958

During 1957 actual television set sales were 6.604.000 The forecasts predict a drop of twenty thousand for 1958.

The great majority of them are in the portable class. Many are going into homes already equipped with a big console model as "second" or even "third" sets for the den or the children's rooms.

Black and white picture tube sales should reach the 7,000,000 mark during 1958 — an increase of 700,000 over last year's total figures. This year, one out of seven TV set owners will replace their old picture tube.

Projection figures show that by 1960, the replacement sales of black and white picture tubes will be approximately 8,300,000.

ABOVE ESTIMATES

Seven million more receiving valves will be sold during 1958 than last year, when total sales reached 185,000,000 exceeding market research projection for 1957 by two million. Seventy per cent will be used in TV set replacement, thirty per cent in radio.

Keeping in mind that receiving valve sales are expected to grow by 7,000,000, the fact that the buying public paid 375,000,000 dollars for receiving tubes alone in 1957 is significant. This dollar figure is **only** for receiving valve sales, not for the total of goods and services purchased for radio and television receivers by consumers. But, a third of a billion dollars, especially when it reflects only a portion of the total amount, is certainly big.

INSTRUMENTS OF QUALITY | FOR INDUSTRIAL AND LAB. USE

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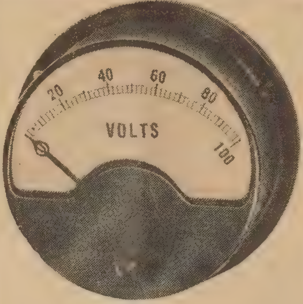
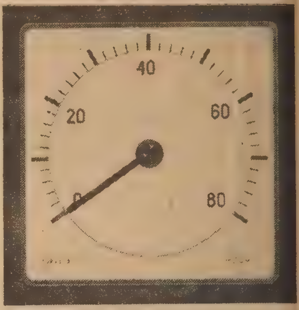
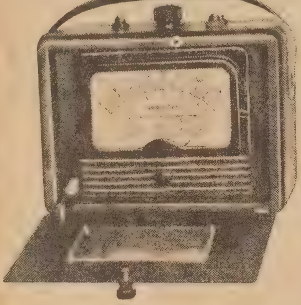
PANEL METERS. A comprehensive range of both moving coil and moving iron types are available in 2", 3", 4" round, square, rectangular and polystyrene meters. Ammeters, voltmeters, m.a. meters, micro-ammeters, VU meters, etc.



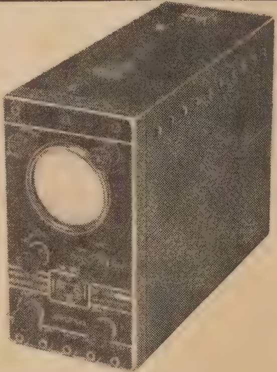
SWITCHBOARD METERS. Heavy-duty meters in nominal 4" and 6" round, flush and projection and other case types are available in all ranges of moving iron, moving coil and special types.



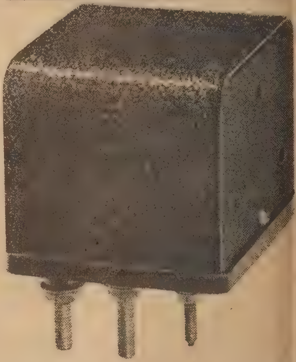
LONG SCALE METERS. Nominal 4" and 6" Long Scale Meters with 270° movement are available in moving iron, moving coil, frequency meters, wattmeters, power factor meters, etc.



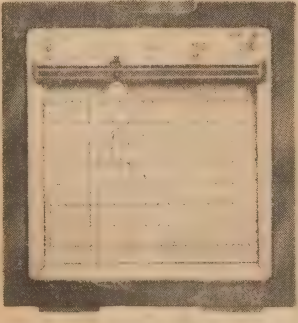
MINING TESTERS. A range of blasting circuit testers, 60-shot exploders and other approved testers are made to standards approved by the New South Wales Department of Mines.



RADIO, TV, TEST EQUIPMENT. A most comprehensive range of radio, television and industrial test equipment is available, embracing multimeters, oscillators, vacuum tube voltmeters, oscilloscopes, sweep and marker generators, battery testers, valve testers, ohmmeters, etc.



LIGHTING PLANT CUT-OUTS. These lighting plant cut-outs are designed to efficiently operate in 32 volts, 50 volts and 110 volts D.C. lighting plant equipment.



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NEWS AND VIEWS OF THE MONTH

Robots run subway

NEW York's vast subway system is to be changed to automation over e next 10 years.

The city's transport authority decided n the change after a strike by train ivers.

The change will mean cutting the aff of 38,000 by half.

Drivers will be replaced by electronic ains and gatekeepers by automatic rnstiles.

But there will be no dismissals the aff has been promised.

The changeover will be gradual and resignations or retirements from the aff will be replaced.

When the changeover comes each ain will be equiped with a master rain-box" slung beneath the carriages d carrying a punched tape directing speed and stoping laces.

Doors will be opened automatically d the train will be "told" by the tape w long to wait, when to sound a arning bell, when to close the doors d when to start.

A transit official said: "The subway ll resemble a toy train operated com- etely automatically.

"Service will be faster and more re- ble.

"They will also be freer of accidents cause of the absence of human fail- e," he said.

Russia has also developed an elec- onic train driver.

The "train driver," known as an auto- atic cybernetic device, obeys all sig- ls, chooses the correct speed and stops stations.

It has been successfully tested on an electric train.

The "reader," built by engineers in Odessa, has a cathode ray tube similar to that in a television set, according to reports.

* * *

Atom safety gadget

EVERY Canadian soldier is being issued with a small instrument that detects nuclear radiation.

The Canadian Army said small dosimeters, which register radiation and provide information for medical authorities, will be worn around the neck like identification tags.

Army units will also be equiped with dosimeters in a fountain-pen style, survey meters to calculate how soon a contaminated area can be re-entered, and a pistol-shaped instrument to detect radiation in clothing and food.

* * *

Human spare parts

MEDICAL research workers in Boston have reported "a big step toward the creation of banks for human organs."

They are trying to develop a "deep freeze" process by which such organs as the heart and the kidney could be preserved, pending their use to replace defective organs.

The Massachusetts Heart Association said that human cells had been frozen to minus 459 degrees Fahrenheit—nearly absolute zero—then "thawed" to normal after long hibernation.

The Association said researchers may not be too far from success in deep freezing organs as well as cells.

But researchers had not found yet how to freeze a heart or kidney below minus four degrees Centigrade (28 degrees Fahrenheit)

The organs suffered damage between four and 10 degrees and would not work again.

The Association said the researchers were trying to produce a deep freezing process which would pass through the danger area before the damage was done.

* * *

Hope for heart cases

THE Heart Association also reports discovery of a mould that tracks down and destroys blood clots, thus promising dramatic and quick relief for heart patients.

The discovery is considered one of the major research developments in the cardio-vascular field in the last 10 years, ranking in importance with penecillin. The mould is completely safe for use with very sick patients, and is expected to prove helpful in relief of persons who had heart attacks, phlebitis, or other conditions connected with blood clotting.

The mould, given by injection, entered the bloodstream, and immediately sought out and destroyed blood clots.

At present the mould is scarce and its production slow.

POPULAR SCIENCE QUIZ

Q.—Is is true that when a bearing is oiled, an oil film prevents the metals from being in contact with each other?

A.—For a long time the action of oil as a lubricant was not clear and it was not unreasonable to doubt that the great pressure set up in some bearings could not allow a film of oil to remain unbroken. However, if a correct oil is used, a film does exist, and in such a case the metal surfaces are not in direct contact. Scientists have carried out many tests to prove this point, including one of electrical resistance which gave a reading much too high for metal-to-metal contact.

The oil film becomes thinner when the load on a bearing is increased, but it becomes thicker again when the speed of rotation is stepped up. At high loads, a film might be 40-millionths of an inch thick. Temperature has a big effect on the thickness of the film, and a change of a few degrees can reduce it by 50 per cent. It would seem that failure of bearing surfaces is firstly a matter of too high temperatures, and secondly too slow rotation under heavy load. Modern lubricants have been developed which show increasing adaptability to changes in operating conditions.

Q.—How much sleep do we need?

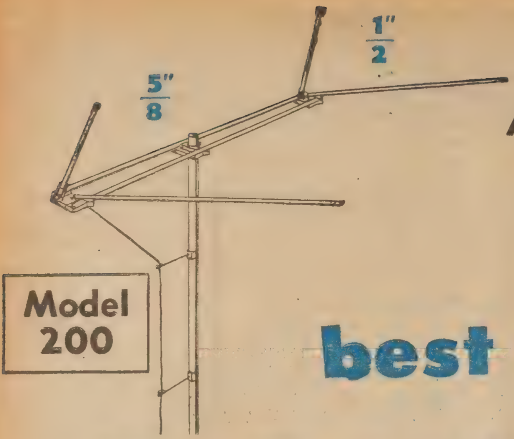
A.—Doctors disagree, but many consider we can do with less than we get. Recently a Soviet biochemist suggested that the body could be exposed to electrical frequencies which would so assist in disposing of fatigue toxins that 1-2 hours would do as well as eight hours, and even extend the life cycle by 20 years. But it is generally accepted that the full importtance of sleep has not yet been understood.

Q.—Do meteors affect radio reception?

A.—Yes, scientists today are meeting with great success in using meteor trails for long-distance reception, as radio waves of appropriate frequency are reflected from them.

These trails must be correctly positioned, and lie roughly along a line joining the two stations in contact. Because of their transient nature, contact is established generally for only a few seconds at a time.

The first station transmits a steady carrier wave which is detected by the second station when the meteor trail arrives. The second station sends out automatic acknowledgment signal, whereupon the first station commences transmitting high-speed tape signals. When contact is lost, the acknowledgment signal disappears, and the first station reverts once again to standby. Distances of 1,000 miles have been used between 30 and 50 megacycles, and radio men expect useful service from this method of transmission using quite low power.



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AF/39.

Kids test rockets

THE U.S. Army may set up roving grounds on which science-minded eenagers can test home-made rockets.

Service and civilian authorities are be oming increasingly alarmed over the umber of accidents involving children xperimenting with rockets.

The rockets—some 12ft long—are owered with explosive propellants hich could bring death to bystanders.

Army inquiries revealed that there re nearly 500 amateurs experimenting n or near New York City.

Pioneer rocket expert Willy Ley said e had discussed with Army officials a lan to set up roving grounds for amteur enthusiasts.

"None of the fuels these kids use is afe when used by an amateur," Ley aid.

"With the amateur proving grounds, xperienced adults would be around to ee that nobody blows his head off."

* * *

as kills germs

UNITED States Army chemists have discovered a germ-killing gas with hich to sterilise hospitals, the New ork Times reports.

The newspaer says the gas is known s beta-propiolactone.

It is a compound used previously for erilisation only in liquid solution.

The Times report said the Army hemists had claimed that beta-propio ictone could sterilise a room in two ours.

Formaldehyde would take 10 hours nd ethylene oxide six hours to sterilise similar area.

* * *

achine therapy

A NEW machine to give low-frequency therapy for nerve and muscle injuries is to be installed at Royal North hore Hospital.

The machine is an electric impulsator quipped with a CRO screen, the first f its kind in Australia.

Imported from Austria at a cost of 350, it will be installed in the hostal's physiotherapy department.

The CRO screen shows the physioerapist the exact amount of power and e manner in which it is conveyed to e patient.

The impulsator is used to restore uscles paralysed by nerve injuries, and ill help paralysed patients to regain e use of their limbs.

* * *

an of the future

MAN'S appearance would undergo a substantial change within about 65 nturies, according to Jay Savage, an merican scientist.

He thinks earth's inhabitants of that riod will have a hairless head, spindly gs, and no toes.

Houses, headgear and umbrellas will ive removed the need for hair. Baldss in both sexes is now increasing.

Mechanism would mean that we ould use our legs a great deal less in e future.

And footwear would make toes unecessary. Already the human little toe s almost disappeared, and has no nction.

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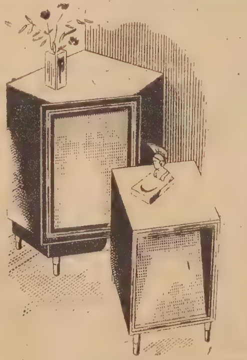

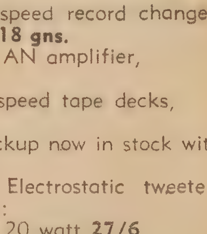

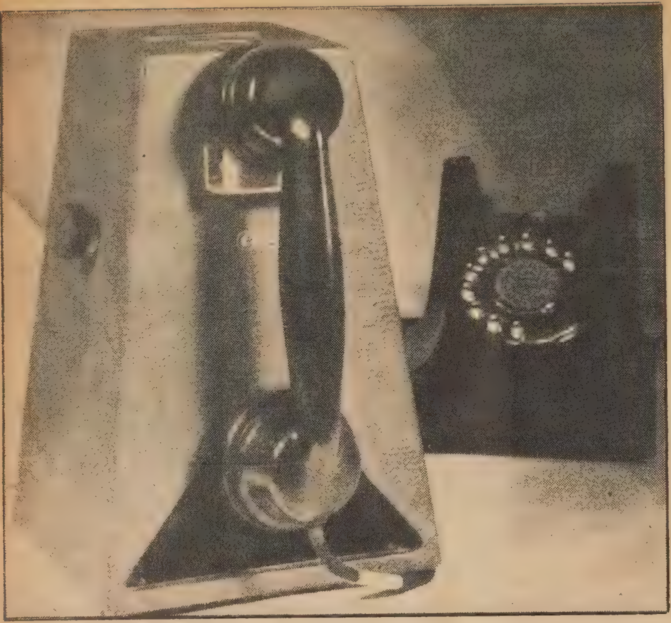

The transistorized telephone amplifier in use. Headpiece is held close to magnetic pickup coil, the output of which is amplified and fed to the speaker mounted in top of case. Volume control is at the side. The horn at the bottom of the case helps to reinforce outgoing speech.

A Transistorized Telephone Amplifier

Here is a new version of one of the handiest gadgets we have ever described. It has a place in every business office where the phrase is so often heard . . ."Just hang on a minute, please." Our telephone amplifier will save you "hanging on", will let you get both hands free to turn up lists and copy down information.

by Maurice Findlay

THE original version was described in the February, 1954 issue and was an immediate success. This new version has all the features of the original with the difference that an extremely economical and reliable transistor amplifier is substituted for the valve amplifier.

RESTATEMENT

The idea behind the new version is just the same as for the original and we can do no better than repeat some of the introduction to the original article. This started off with a discussion about the time wasted per day waiting on one end of a telephone while someone at the other end searches for a wanted party.

Anyone who has worked in a business office will readily appreciate the problem. The routine goes something like this:

You wish to ring Brown and Co. and speak to Mr. Smith, but the first couple of attempts to dial their number results in an engaged signal. (After all, Brown and Co. are a busy firm).

Eventually, having already wasted much precious time, you succeed in making contact and ask for Mr. Smith.

Then the fun starts. Mr. Smith is either engaged on another line, bus with a client, or just cannot be foun for the moment. "He will probably b available in a few minutes," says th switch girl. "Will you wait on?"

Remembering the difficulty you hav already had getting this far, you decid to wait on. The minutes drag by. Ther are many things which you could b doing while you wait, but with onl one hand free you are practically i capacitated. You try to make a fe notes about something you just remen bered, but the paper slides all over t desk.

You try to refer to a catalogue b find it almost impossible to keep it op at the page you want. Eventually yo resign yourself to sitting and waitir until Mr Smith is available, which m render you immobile for up to 10 mi utes.

WORTH HOUR PER DAY

By the time this procedure has be repeated several times a day it is qui easy to waste an hour or more, simp because one must hold the telepho to one's ear while waiting for someo to answer it.

It is obvious enough that, if one cou couple a simple amplifier to the pho to raise the incoming signal to lou speaker level, it would be possible monitor the circuit while continuing wi other work.

From this thought was born the id of a "telephone minder." After a prac cal test it became apparent that su a set-up was capable of working in bo directions, at least under favourable co ditions, due to the high sensitivity the modern telephone transmitter.

By adding a simple horn, wh would collect the sound more efficient it was possible to improve results enou for a "loudspeaking telephone" to b come a real possibility.

Apart from its use as a telepho minder, it is extremely valuable wh notes have to be made from informat received by phone, since it leaves b hands free while still providing ta back facilities to permit checking.

Similarly, when data have to be giv over the phone, it is frequently necess to refer to books or thumb thro files, a process which can be extrem difficult with only one hand.

A good idea of the device in present form can be obtained from photographs. It consists of a pyram shaped case occupying no more d space than an ordinary telephone which houses the amplifier, batt speaker, horn, etc., making the completely self-contained.

SIMPLE IN USE

In use, the handset is simply h on the front of the case, which ac operates a simple gravity switch turns on the amplifier. At the same t the handset rests in such a position the receiver couples automatically to pickup coil while the mouthpiece in the throat of the horn.

TO THE READER

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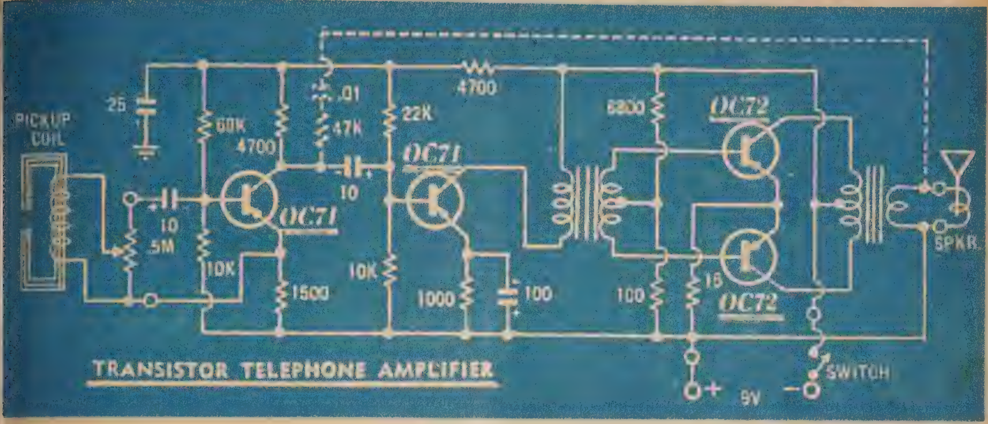
CIRCUIT OF THE NEW TRANSISTOR AMPLIFIER



The amplifier includes circuits to ensure stability of operation at any likely temperature. Maximum power actually delivered to the speaker is about 250 mV (greater than in the case of the original valve amplifier) and there is a reserve of gain. The feedback circuit is optional.

Signals from the receiver will be heard rough the loudspeaker in the top of e case while speech may be directed the transmitter horn.

The distance at which one may work om the transmitter depends on sev- al factors, including the efficiency of e particular telephone channel, but it ill usually be quite satisfactory up to 2 inches.

This is quite enough to allow a note- ad or other data to occupy the desk etween the operator and the instrument. Under more favourable conditions eater distances may be possible.

There is one question which we know ur more technically-minded readers are ist itching to ask, namely, "What about edback?"

EEDBACK

This is quite a reasonable query be- ause, at first glance, it would appear at the set-up is a "sitter" for such complication. The main reason for is is the fact that in any ordinary lephone circuit the one pair of wires arries the signals in both directions and e receiver in any telephone is there- re connected across its own transmitter.

For this reason there is always an cho of one's own voice in the receiver, s well as considerable pick-up of the eneral noise level in the vicinity. This known in telephone parlance as "side ne" and it can cause serious inter- erence to the distant signal when one's wn phone is being operated in a noisy cation.

In an effort to overcome this prob- em, P.M.G. engineers developed what is nown as an "anti-side tone circuit."

This is an ingenious arrangement hereby the local receiver is effectively olated from the local transmitter, ough still in circuit as far as the istant transmitter is concerned.

For various reasons the isolation is ot made complete (though it could be) ut is sufficient to improve performance onsiderably in noisy locations.

What is more important as far as we are concerned is the fact that the possibility of feedback is reduced in direct proportion to the degree of isolation between the two halves of the circuit and, since most phones are now fitted with this circuitry, the problem is much easier than otherwise.

PLENTY OF VOLUME

It must not be inferred that feedback will not take place, because it certainly will if the gain is high enough, but it does mean that, by careful placing of the speaker and horn, it is possible to operate the speaker at a perfectly satisfactory level without trouble.

So much, then, for the general considerations. Now let us consider the practical unit in detail.

To ensure efficient operation of the microphone insert, we designed the unit to hold the handset in an upright position and, because there appears to be an even chance that a user will want to hang it on either the right or left-hand side, we hung it on the front.

This also makes the design of the horn much simpler. Bringing the received sound out the top helps to isolate it from the horn, this being further assisted by the shelf holding the amplifier.

Since it is an offence under P.M.G. regulations to make any physical connection to the telephone circuit, connection to the receiver is made magnetically.

There are many ways of doing this, and practically any iron-cored winding will provide some measure of pickup. However, a reasonably efficient system is desirable if the amplifier is to be kept simple.

For the pickup coil, we used a pair of headphone bobbins. These are available from disposals headphones or, alternatively, could be obtained new from one of the manufacturers of telephone equipment. Each coil has a nominal DC resistance of 100 ohms.

The core is made from a few pieces of stalloy such as can easily be obtained from a discarded transformer stack. Following the design of the tape heads, we bent two "U" shaped pieces, one slightly smaller than the other and designed to fit inside it, to form one half of the core.

MAGNETIC HEAD

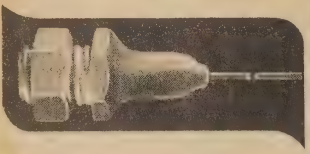
The coils are mounted side by side, one on each leg of the "U", and a strip of stalloy inserted in the opposite side of each to form the actual pickup poles of the system.

The coils are mounted behind the front panel of the case and the pickup poles of the core are brought out to the front through two narrow saw cuts in the panel.

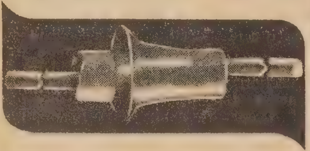
PARTS LIST

1 case (see diagram)
1 bakelite panel 5¼in by 2⅜in
1 3in permag. speaker
2 OC71 transistors
2 OC72 transistors with heat sinks
RESISTORS all half watt. 1 15 ohm, 1 100 ohm, 1 1,000 ohm, 1 1,500 ohm, 2 4,700 ohm, 1 6,800 ohm, 2 10K, 1 22K, 1 47K, 1 68K and 1 0.5 meg pot.
CAPACITORS 1 0.01 uF 200V, 2 10 uF 12V, 1 25 uF 12V, 1 100 uF 3V.
1 special output transformer (300 ohms to 3.5 ohms)
1 special driver transformer
1 600 type relay with 1 normally open contact complete with yoke and armature but minus coil.
2 500 ohm headphone bobbins
Strips of stalloy for pole pieces
1 276P 9V battery
Plug for battery, hook-up wire, nuts, bolts, tinplate for horn, scrap aluminum &c.

MINIATURISED RADIO & TV Components

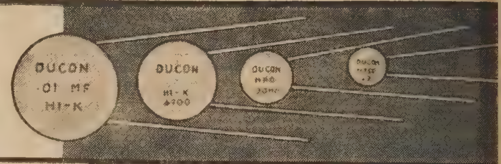


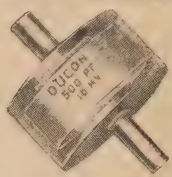
TYPE CAE—Screw mounting stand-off variety in capacity ranges of 100 pf. min. to 3000 pf. max.



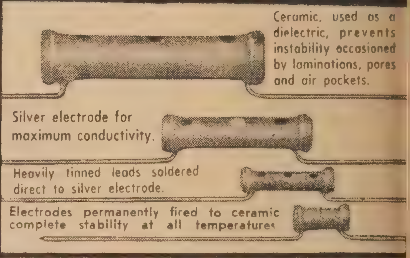
TYPE CAC 100—Feed-thru flange mounting type can be soldered direct to the chassis or shield plate in tuner units. From 50 pf. min. to 1500 pf. max.

The disc ceramic, with its short rf current path, when soldered direct to the tube terminals, reduces the inductance to very small values.





Type TV high voltage disc capacitors encased in "DURITE", for T.V., and other high voltage applications.

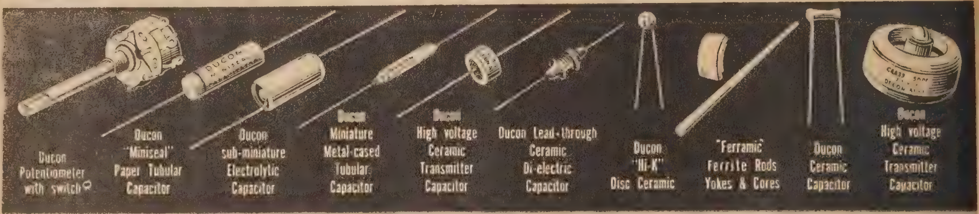


Ceramic, used as a dielectric, prevents instability occasioned by laminations, pores and air pockets.

Silver electrode for maximum conductivity.

Heavily tinned leads soldered direct to silver electrode.

Electrodes permanently fired to ceramic complete stability at all temperatures



Ducon Potentiometer with switch

Ducon "Miniseal" Paper Tubular Capacitor

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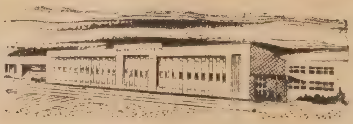
Ducon "Hi-K" Disc Ceramic

"Ferramic" Ferrite Rods Yokes & Cores

Ducon Ceramic Capacitor

Ducon High voltage Ceramic Transmitter Capacitor

TYPE CAC—Feed-thru flange mounting type can be soldered direct to the chassis or shield plate in tuner units. From 50 pf. min. to 1500 pf. max.



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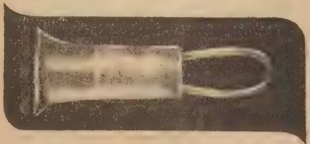

TYPE CAE 100—Stand-off flange mounting style mounted by soldering to the chassis. From 50 pf. min. to 1500 pf max.

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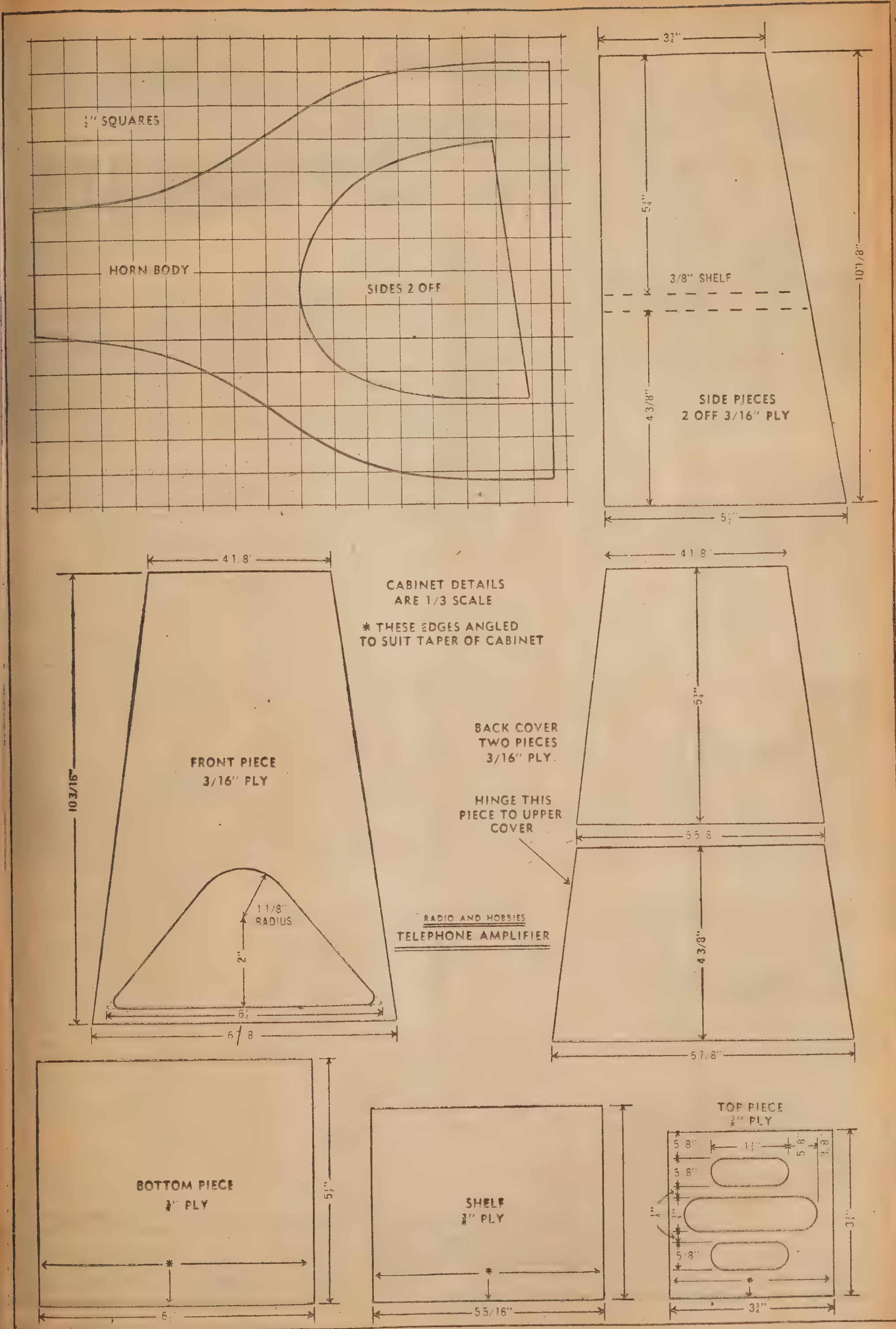

½" SQUARES
HORN BODY
SIDES 2 OFF
3¾"
5¾"
3/8" SHELF
10 1/8"
4 3/8"
SIDE PIECES
2 OFF 3/16" PLY
5½"
4 1/8"
10 3/16"
FRONT PIECE
3/16" PLY
1 1/8" RADIUS
2"
6¼
6 7/8
4 1/8"
5¾"
BACK COVER
TWO PIECES
3/16" PLY
HINGE THIS
PIECE TO UPPER
COVER
5 5/8
4 3/8"
5 7/8"
BOTTOM PIECE
⅜" PLY
5½"
6¼
SHELF
⅜" PLY
5 5/16"
TOP PIECE
⅜" PLY
5/8"
1¾"
5/8"
3/8
5/8"
¾"
1¼"
5/8"
3¼"
3¾"

CABINET DETAILS
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* THESE EDGES ANGLED
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TELEPHONE AMPLIFIER

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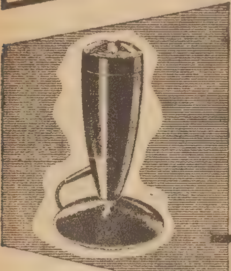


DESK or HAND MICROPHONE, MIC36

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost **PRICE, £6/18/6.**

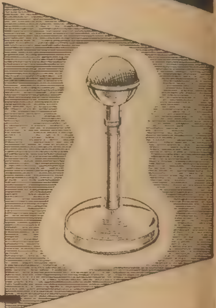
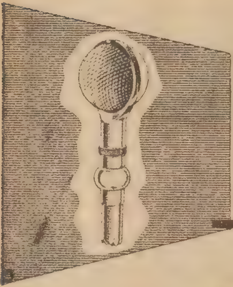


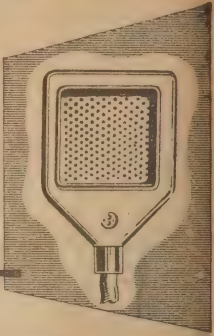
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**



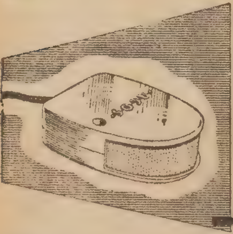
HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



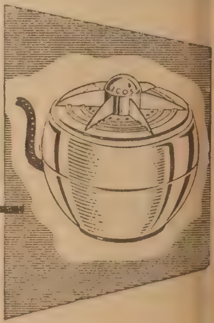
LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel **PRICE, £5/19/6.**



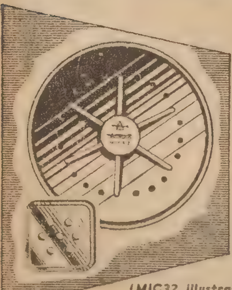
GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**



HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



(MIC32 illustrated)
(MIC23 illustrated)

CRYSTAL MICROPHONE INSERTS

These inserts are available in varying sizes, ranging from as small as $\frac{13}{16}$ in. square to 1-$\frac{13}{16}$ in. round, with various thicknesses from $\frac{3}{32}$ in. to $\frac{5}{16}$ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6**; all others, **£1/19/6.**

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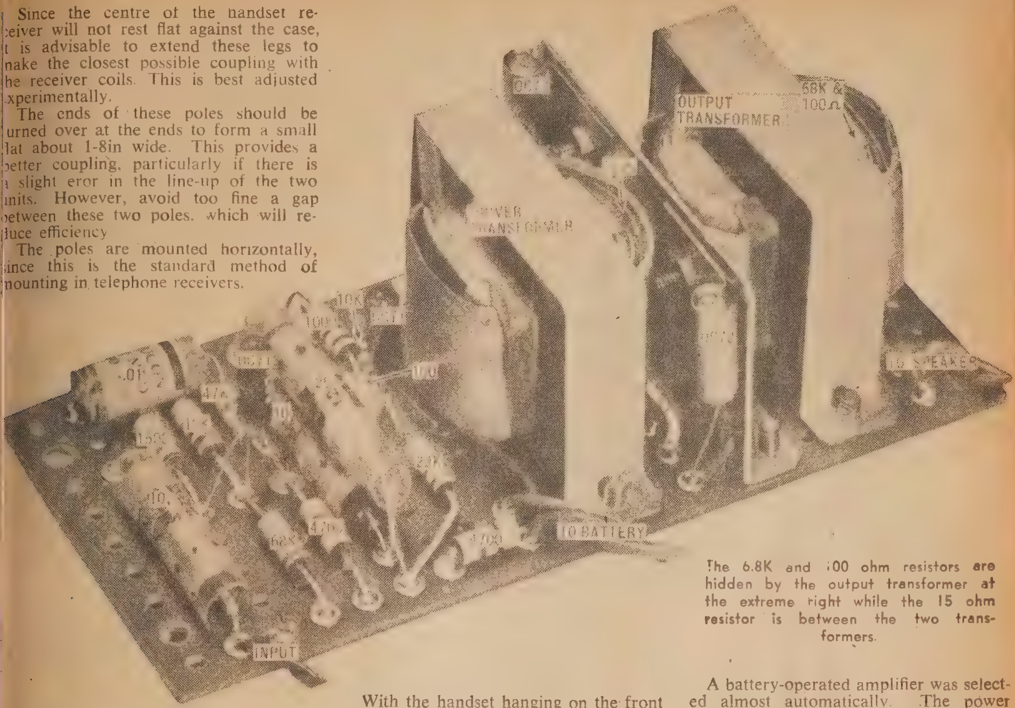
Sydney, N.S.W. Phone LA 6124.

Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.

Since the centre of the handset receiver will not rest flat against the case, t is advisable to extend these legs to nake the closest possible coupling with he receiver coils. This is best adjusted xperimentally.

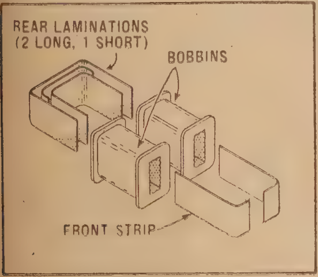
The ends of these poles should be urned over at the ends to form a small lat about 1-8in wide. This provides a better coupling, particularly if there is a slight eror in the line-up of the two units. However, avoid too fine a gap between these two poles, which will reduce efficiency

The poles are mounted horizontally, since this is the standard method of mounting in telephone receivers.



The 6.8K and 100 ohm resistors are hidden by the output transformer at the extreme right while the 15 ohm resistor is between the two transformers.

In our case, the top pole was mounted 7-8in from the top of the case (outside) and the spacing between the slots 7-16in These figures are only given as a guide and the position should be finally determined experimentally by removing the cover of the receiver and noting the position of the poles.



The magnetic pickup head.

We tried mu-metal in place of the stalloy, and this does give slightly better results, but it is not essential and hardly worth chasing if it is not readily available

A two-terminal tag strip is mounted alongside the coils, held in place with a countersunk screw through the side of the case. It provides a termination for the fine leads from the coils.

The coils should be connected in series aiding and this is achieved by connecting the two outside leads together and taking the two inside leads to the amplifier.

With the handset hanging on the front of the case the mouthpiece will be facing away from the user and speech pickup under these conditions is poor. The horn is, therefore, designed to collect the sound from the speaker, and turn it through 180 degrees into the mouthpiece, as well as increasing the area of sound pickup.

We conducted several experiments with various shapes to determine a suitable one and finally reached the conclusion that a simple design is practically as effective as a more complicated one

MAKING THE HORN

The final design consists of a simple elliptical fold with sloping sides, and a good idea of it can be obtained from the scale drawing.

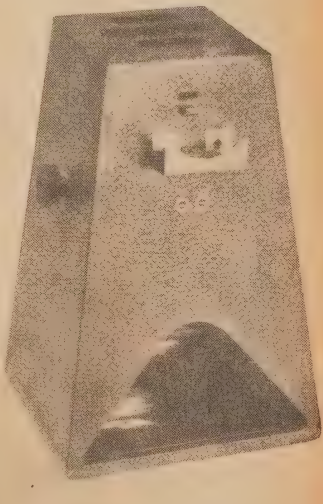
The original was made from 22-gauge tinplate and it should ont be difficult for the home constructor to duplicate our effort by scaling up the drawing to full size.

If tinplate is not readily available in sheet form it should be possible to obtain enough material from a couple of discarded jam tins, or similar containers All that is then required is a pair of tin snips and a soldering iron. When finished it can be given a coat of black lacquer and its humble origin will never be suspected.

The horn is mounted against the front of the case behind the triangular cutout and is held in place by means of two 1-8in machine screws through the bottom near each front corner This should force the top of the horn against the front of the case. The heads of the screws should be given a dab of black lacquer also, to match the horn.

A battery-operated amplifier was selected almost automatically. The power available is quite adequate for applications of this kind, and the intermittent nature of the operation ensures long battery life.

The original telephone amplifier described in the February, 1954, issue, used two valves. However, in the intervening four years transistors have been developed to the point where thev offer advant-



The position of the magnetic head clearly visible in this photograph without the handpiece

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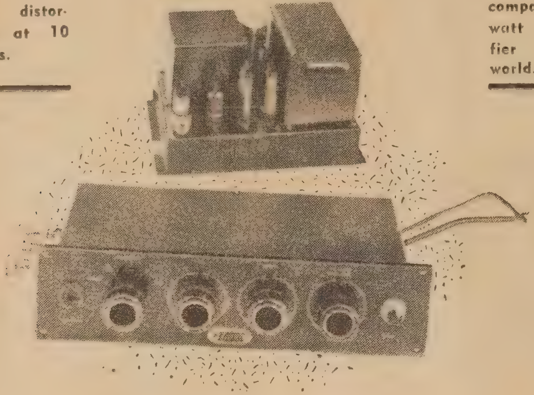

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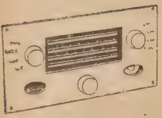

Armstrong AM 44 tuner. All wave with variable bandwidth.

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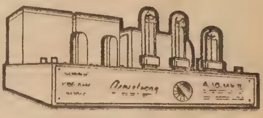

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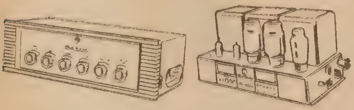
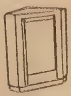


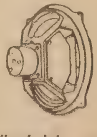
RCA Orthophonic amplifier and preamplifier, £139/10/-.

Garrard 301 turntables. C.E.C. turntables.



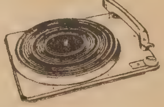
Altec and Wharfedale corner enclosures, £42/10/-

Enclosure kits fully assembled ready for painting or polishing, £15/15/-.



Wharfedale super 12in FSAL speakers.

Barker Duode loudspeakers.



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ages over valves in the present application.

All things considered, the averag power consumption of a transistor amplifier is likely to be only about 1-10th or less the power consumption of valve amplifier with the same maximum capabilities.

The supply position of transistors gradually improving and it is probabl that readers wishing to build the nev telephone amplifier will have no difficult in buying all the transistors over th counter. However, there may be od occasions when it will not be possibl to buy the OC72's we have chosen fo the output stage and we would advis readers to buy their OC72's before an other components. The supply positio for the OC71's should not present an difficulties.

While it is not appropriate in a practical article such as this to take too muc space discussing the electrical design o the amplifier, there are a few remark which are appropriate.

First of all, transistors are sensitive t temperature. Their characteristic change, particularly with high temperatures, and it is necessary to take specia precautions in the design to ensure tha the amplifier will operate successfull over the entire temperature range.

The most suitable temperature stab lising arrangements takes the form of resistive network. All values are capabl of calculation to give a desired degre of stability. Greater temperature stabilit than has been designed into our amplifie is possible, but we believe that we hav chosen the best compromise betwee several conflicting factors.

HIGH EFFICIENCY

The output transistors are operate under class B conditions. This mear that the base bias current is adjusted s that the collector current is almost zer with no signal. When drive is applie the collector current of the opposite trar sistors increase alternatively with succe sive half cycles of the signal. The ave age current drain is nearly proportion to the amplitude of the signal.

This type of circuit is very efficie by comparison with other circuits an even taking into account the variou losses which occur in a practical amplifier, efficiencies of the order of 70 pe cent are not unusual.

The detail of the design of the oupt stage is closely dependent on the ba tery supply voltage. From the point view of the transistors it would hav been quite practical to have designed th output stage to operate on any one fixe voltage between about 4 and 12 volt

However, inquiries revealed that ther is a tendency among manufacturers transistor portables and transistor amplifiers to standardise on a nine vo supply. Batteries of this voltage wi eventually be available in at least thre different sizes.

With the nine volt supply a suitab collector to collector load resistance 300 ohms when the transistors will develop a power output of about 350 mW Loudspeakers commonly available hav voice coil impedances of a few ohn only and therefore a matching tran former is required.

We used the Rola 3C speaker whic has a nominal voice coil impedance 3.5 ohms in conjunction with the Fe guson OP370 transformer designed match 300 ohms to 3.5 ohms.

he driver transformer used in the inal amplifier is the Ferguson 355 The ratio of this transformer been designed specially to fit in with operating conditions for the OC71 ver stage and has a slightly different o to other designs for the same volt- . The basic thinking behind our ign has been to supply a slight re- ve of drive at the expense of slightly eased driver current drain.

he whole matter of transistor trans- ner design locally is only in its initial es and there is no doubt that there be improvements in time to come. most obvious room for improvement n the matter of size. The volume of n could be much less than that in the sent transformers while still main- ing excellent characteristics.

he remainder of the amplifier fol- s fairly conventional resistance acity coupled design and includes cir- s to maintain the operating point ly stable with changes in tempera- .

Miniature low voltage electrolytic acitors are expected to be available several brands before too long but may find that your usual supplier not have exactly what you require stock. In general, you could use arger value for the electrolytics, pro- ed the voltage rating is adequate. its which are larger physically could be used but with the obvious dis- antage of spoiling the layout. You note that the need for the electro- c across the emitter resistor of the t transistor has been avoided by re- ning the input circuit direct to the itter

EQUENCY RESPONSE

For the amplifier without feedback, minus 3 db points occur at about cps at the low end and 5 Kc at high end of the range. It will be nd to have a reserve of gain with st magnetic pickup heads and negative dback of about 6 db can be applied h advantage.

Approximately this amount of feed- k will be obtained by connecting a 000 ohm resistor between the collector the input transistor and the voice winding of the output transformer. e correct polarity should be found erimentally by reversing the VC ding connections.) With feedback, minus 3 db points will be found to at 100 cps and 8 Kc.

n practice the limit to the volume t you can use, depends on the amount gain which can be obtained with bility. Telephone circuits generally d to have a rising frequency response greater effective volume from the nsistor amplifier may be obtained by sting the bass with respect to the her frequencies.

Considering all factors, a .01 uF acitor in series with the feedback istor appears to give the best results the output rises gently with dimin- ing frequency until it reaches a peak about 200 cps.

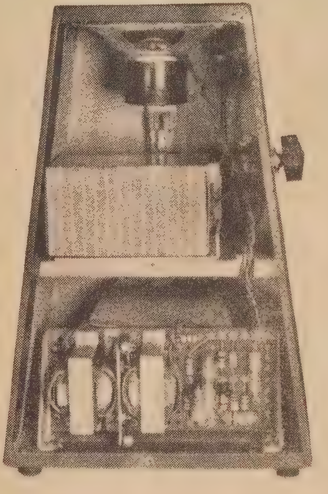
The main points which remain to be cussed concern the mechanical con- ction of the amplifier and the case. components can conveniently be unted on a piece of bakelite with ropriate holes or a piece of matrix rd. This form of construction is more suitable than a conventional ssis, and there is no serious danger feedback in the case of unshielded cuits because of the low impedance.

It is necessary that the output transistors be mounted on a heat sink. In our case, this takes the form of aluminium sheet 2½in by 1½in, with one of the 2½in sides bent up ⅜in to form a mounting foot. The transistors are normally supplied complete with specially shaped mounting pieces which contain and permit them to be attached to the heat sink with a single bolt.

Small eyelets make convenient tag points in the bakelite. They are quite easily secured by tapping on the reverse side with a cone-shaped punch which spreads the body.

The general plan of the layout follows the theoretical diagram with one or two exceptions which have been included to make the amplifier more compact. The location of most of the parts can be judged from the coded photograph.

From the mechanical features of the amplifier we can now go on to talk about making the case and the on-off switch which is actuated by the telephone hand set.



A rear view of the unit

There are many possible arrangements for the actual switch hook and the reader with a well-stocked junkbox and a little ingenuity will probably be able to evolve a scheme to suit his own requirements. However, the scheme which we have worked out appears to be as good as any and has the advantage of using standard components which, while not usually available from a radio dealer's shelf, can be obtained on special order.

We found it most satisfactory to provide a rigid bracket to take the weight of the handset, thus ensuring that it always rests in the correct position relative to the horn. This consists of a "U"-shaped bracket, approximately ⅜in on all three sides and 2in long. One side, which mounts against the front of the case, is cut out to allow the arm of the switch hook to pass through to a point where it will be operated by the lower edge of the receiver case.

The opposite side has a curved cutout to suit the curve of the handset, and a good idea of the arrangement can be obtained from the photograph of the finished unit The details of the bracket

(Continued on page 127)

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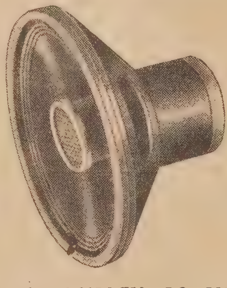

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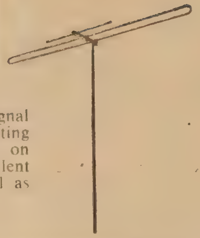

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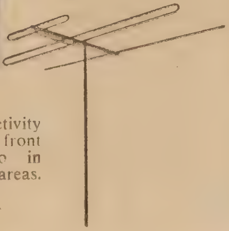

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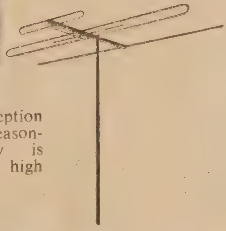

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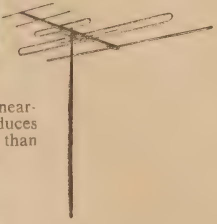

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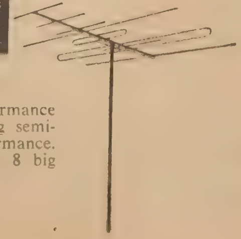

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All About Audio and Hi-Fi

Electrostatic Speakers & Transient Response

By G. A. BRIGGS

(Managing Director Wharfdale Wireless Works Ltd.)

PART 6—Matching electrostatic tweeters to amplifiers and factors that affect transient response of speakers.

THE question of load matching between amplifiers and electrostatic peakers is rather involved and the problems are not yet generally understood. Mr R. E. Cooke, our technical director, has been making an investigation into what happens, and I do not mind admitting that I read his findings in statu pupillari (as a student); he admits with becoming modesty that he learned quite a bit himself. Here is the report in Mr Cooke's own words. (As this is the sixth article in the series, it is time he showed his hand).

For the sake of simplicity we usually efer to impedance by its numerical value alone but, as the term implies we are really dealing with a complex mixture of resistance and reactance Reactance is the technical term for the blocking action due to an inductor or capacitor and the amount of reactance associated with a given impedance is often expressed as a phase angle. The sign of the phase angle, i.e.. plus or minus, indicates whether the reactance is inductive or capacitive in nature, as he case may be.

PHASE ANGLES

For the purpose of simple discussion we can say that a phase angle of plus 90 deg. corresponds to pure inductance and minus 90 deg. corresponds to pure capacitance, while zero angle indicates pure resistance. Intermediate values reate to mixtures of resistance and reactance which may be inductive (positive) or capacitive (negative) in character.

Fig. One shows the phase angle and mpedance characteristics of a 10 inch moving-coil loudspeaker with foam suspension when mounted on a plane baffle 2½ feet square. The measu.ements were carried out using a Muirhead impedance and phase angle meter Type D-728A in conjunction with a b.f.o. and standard resistance box.

The impedance curve is quite ordinary and shows the usual peak at the fundamental resonance frequency, with a gradual rise above 400 cps due to voice-coil inductance. The phase angle curve is relatively unfamiliar, however, and shows that this typical unit behaves like a pure resistive load at two frequencies only. The lower one corresponds to the fundamental resonance at 31 cps, and the upper frequency is 300 cps which occurs in the region of the lowest impedance value normally used for matching purposes. Between these two frequencies the loudspeaker is capacitive in its behaviour, while outside that region it behaves inductively.

We know from experience that most power amplifiers are quite happy when feeding loads of this type but it is generally accepted that electrostatic speakers present some new load matching problems; so we cannot do better than start by inspecting the phase-angle and

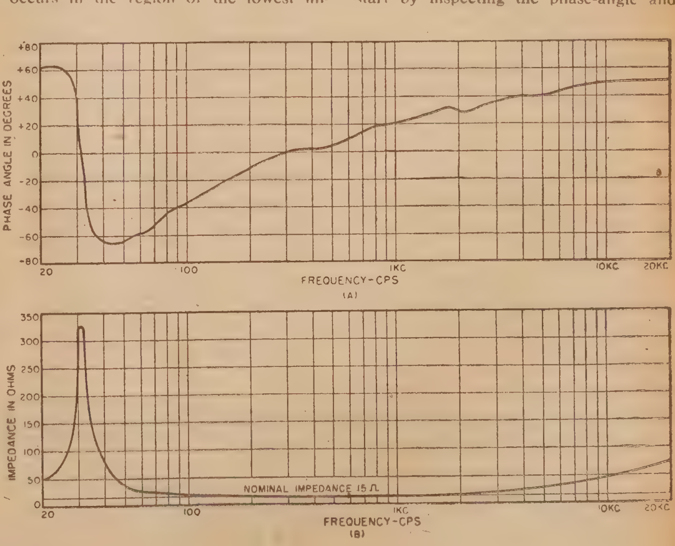

Fig. 1 — Phase angle and impedance of 10-inch moving-coil speaker on a flat baffle.

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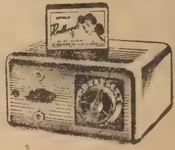

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edance curves of a typical push-pull trostatic tweeter of the latest type. hese are shown in Fig. 2, and we see at once that electrostatics bee quite differently from moving coils. s particular electrostatic unit cons a built-in high-pass filter incorating an inductor, which accounts the peak in the impedance curve as l as for the positive phase angle be 2,000 cps.

lthough the operating range is from cps upwards, the interesting part the curves is in the region above 00 cps, where the impedance falls idly to 5 ohms at 15,000 cps alugh the unit is nominally rated at ohms.

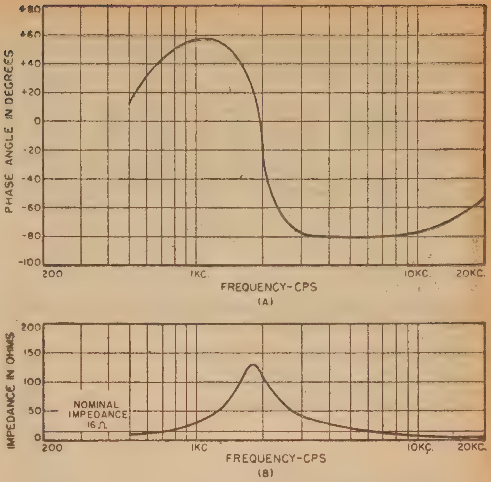
ver a large part of the working ge the phase angle is around minus degrees which approximates to a pure acitance. This contrasts sharply with moving-coil unit, which is inductive the upper frequency range.

lany power amplifiers employ over negative feedback taken from the ondary of the output transformer. The d-speaker load is therefore included part of the feedback loop and its se characteristics must be taken into ount. In order to maintain stability, phase of the feedback voltage must ain within certain limits and some plifiers which have been designed to rk with moving-coil loud-speakers y become unstable when faced with trostatics.

ABLE AMPLIFIERS

owever, there is no fundamental iculty in building an amplifier which l remain stable while feeding this type load and in course of time all highality power amplifiers will be designed h such operating conditions in view. The real snag in matching an electrotic loud-speaker to its driving ampli is the problem of developing an quate voltage across the loud-speaker minals over the whole operating freency range. The trouble arises bese vacuum tubes are voltage amplify devices which do not like working o low impedances. Consequently, alugh the average amplifier is not unly worried by loads greater than the minal matched impedance, the onset distortion is usually serious if the d impedance falls very much below nominal matched value, and the same wer output is expected.

In order to obtain some factual inmation, tests were carried out on a od quality power amplifier of repule vintage.



☆

Fig. 2 ← Here are shown the phase angle (upper curve) and impedance (lower curve) of a push-pull electrostatic tweeter. Note that, as is to be expected, phase angle is in the order of minus 80 degrees, which approximates a purely capacitive circuit.

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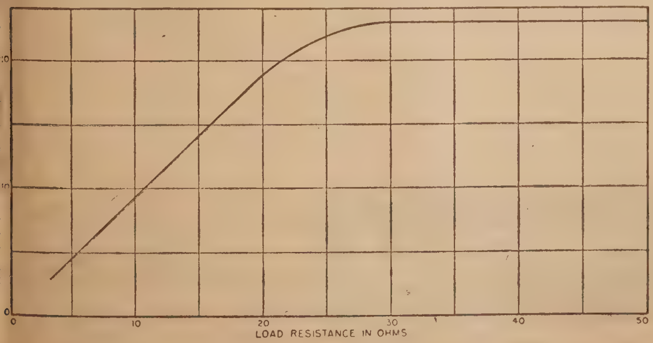

Fig. 3 — Effect of varying load resistance on maximum output voltage at 15,000 c.p.s.

Its power output was rated at 12 watts and its nominal matching impedance was 16 ohms.

Fig. 3 shows the effect of varying load resistance on the maximum output voltage at 15,000 cps. Similar results were obtained at other frequencies in the working range; 15,000 cps was adopted here because we happen to be interested in high-frequency performance for purposes of this discussion.

The curve shows that the maximum voltage available, just short of clipping, falls away drastically as load resistance is reduced. For example, with a resistance of 5 ohms only 4.5 volts were available as compared with 15 volts across 16 ohms, corresponding to a drop of 10.5 db in maximum output voltage. In other words, when faced with a load resistance of 5 ohms the output of this amplifier is only equivalent to 1¼ watts related to its matching impedance of 16 ohms.

REACTIVE LOADS

Fortunately, most practical amplifiers seem to have a slightly better performance as regards distortion and overload when working into reactive loads, and it appears that the resistance load is the worst case. When the electrostatic unit was connected to the amplifier used for the previous test, a maximum voltage of 5.7 was obtainable at 15,000 cps which, although better than the 4.5 volts obtained with a resistive load of the same value (5 ohms), is still 9 db below 15 volts.

This drop of 9 db does not mean that the output will be 9 db down at 15,000 cps during normal operating conditions. What it does mean is that this particular amplifier/loudspeaker combination will handle 9 db less input at 15,000 cps without distortion relative to the midrange input.

Thus if the amplifier is fed with a 15,000 cps signal and the level gradually increased, it is obvious that distortion will occur earlier than would have been the case with a load impedance of 16 ohms or more. The position could of course be eased by treating the loudspeaker as a 5-ohm unit and rematching with a suitable transformer, but this would result in a loss of sensitivity amounting to 5 db which would be unacceptable, especially in view of the fact that the electrostatic unit is already less sensitive than highflux, moving-coil types.

Full-range electrostatic loudspeakers behave in a similar fashion at high frequencies, but the impedance can be prevented from rising too severely at middle frequencies by crossing over to an electrostatic bass section at a carefully chosen point. Clever circuit design also helps matters here, an artifice not open to the tweeter manufacturer because he has no control over the type of bass speaker with which his unit may ultimately have to work.

NOMINAL IMPEDANCE

As the frequency goes down, the impedance continues to rise, as one would expect with a capacitive device. In a typical case the impedance of a nominal 15-ohm electrostatic unit reaches 30 ohms to 40 cps.

This is actually a benefit because the electrostatic is a voltage-operated device and the rising impedance ensures that the amplifier can maintain its drive down to the lowest frequencies.

On the other hand, the operation of a moving-coil speaker depends upon current, so that an impedance rise at low frequencies results in more difficult conditions for bass reproduction.

The question which now arises is whether this falling high-frequency impedance will cause the amplifier to run into distortion on speech and music, and

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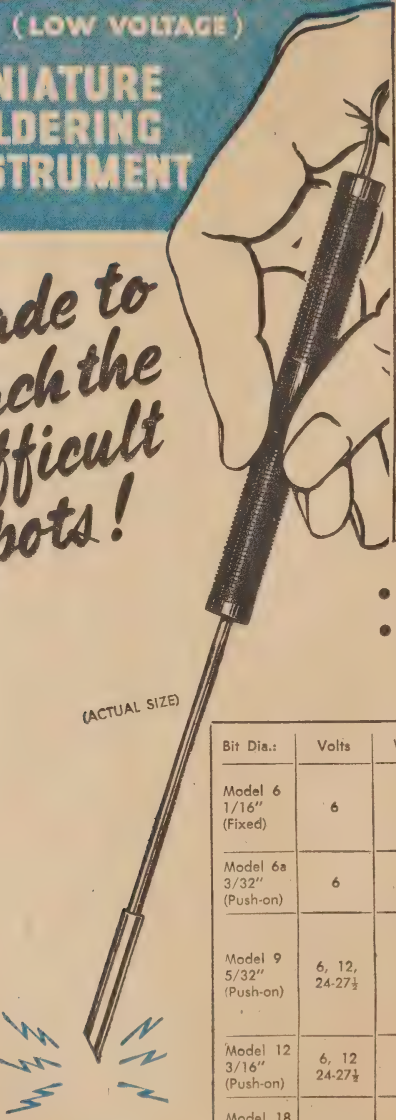

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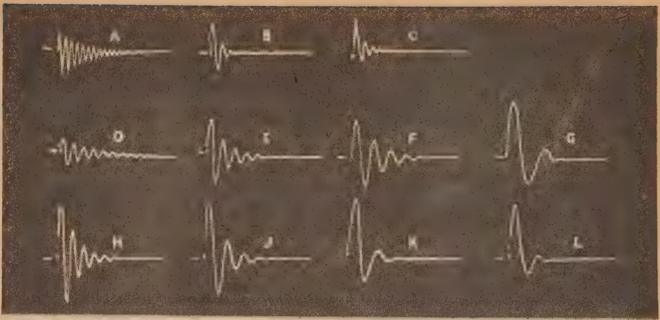

Fig. 4 — Actual photographs of oscilloscope records of the shock effect on various speaker/cone/coil/magnet assemblies. (A) A 6-inch unit with low flux density, corrugated cone suspension. Note "ringing" with exponential decay rate and 22 vibrations before cone comes to rest. (B) A 5-inch unit with high flux density, cloth suspension, and a finer spider. Note big improvement over part A. Input at 0.5 volt. (C) Same as part B, but magnet reduced from 13,000 gauss to 5,000. Note the 7 or 8 oscillations instead of previous 4 or 5. Input increased to 1.5 volts to make up for loss of sensitivity. (D) An 8-inch speaker with 8,000-gauss magnet. A corrugated cone suspension is used. (E) Same as for part D but speaker uses a 13,000-gauss magnet. Note the greater sensitivity and better damping shown by the rapid rate of decay, with fewer oscillations. (F) Same as for part E but with cloth suspension, which lowers the frequency of the cone resonance and, in addition, reduces the number of vibrations. (G) Goodmans 8-inch unit with free-edge cone and saturated pole. Low resonance frequency and rapid decay rate is shown. (Note: The unit was referred to in previous article.) (H) A typical 12-inch unit with corrugated cone and a 13,000-gauss magnet. (J) Same as for part H but with cloth surround. Note the obvious improvement. (K) Same as for part J but magnet improved to 17,000 gauss. Again there is an obvious improvement. (L) A 15-inch unit with a large magnet. There is little or no ringing here.

the usual crop of if's and but's ns to sprout.

ertainly there is a tremendous unt of energy in sounds such as a bal crash, which make heavy de- ds upon the power amplifier, es- ally if recorded out of balance and oduced at high level. It is therefore y that electrostatic speakers will re- e the use of amplifiers in excess of watts' rating if full-blooded reprod- on is required.

his increase in power is necessitated ly by the lower sensitivity of cur- electrostatic designs as compared moving-coil types and partly by the natch referred to previously. It seems ly that 30-50 watt amplifiers will be- e more common as the electrostatic dawns and develops.

ow that we have reached the sub- of loudspeaker watts, this seems a place to point out a few common icies. With the moving-coil loud- ker most of our calculations are d on the nominal impedance at nd 300-400 cps where we see from One, the load is almost a pure re- nce. In these circumstances it is nissible to calculate the power ab- ed by the speaker from the formula:

$$\text{Power} = \frac{V^2}{Z}\ \text{watts}$$

ere: V = voltage across voice coil
Z = loudspeaker impedance in ohms.

hus in the case of the unit of Fig. for 4 volts across the voice coil the er input would be:

$$\frac{4^2}{15} = 1.07\ \text{watts}$$

t all other frequencies, variations in edance and phase angle must be n into account by inserting phase le into the formula, thus:

$$\text{Power} = \frac{V^2 \cos \phi}{Z}\ \text{watts}$$

here: ϕ is the phase angle.

Hence for the same 4 volts at 31 cps, power input has fallen to 0.05 watt. hough the power input to the unit fallen so drastically, it must be re- nbered that the efficiency has in- ased enormously, due to the fund- ental resonance which occurs at 31 The actual sound power output is efore maintained to a great extent. ilarly, at 15,000 cps the input power).16 watt, but here there is no re- ance to boost efficiency so that the put falls accordingly. (Hence the im- tance of avoiding the impedance rise much as possible, as already pointed in Part 5.).

t is interesting to look at the elec- tatic tweeter from the point of view power absorbed for the same input 4 volts. At 1950 cps where the phase le is zero, the power absorbed is watt; while at 15,000 cps the er is 1¼ watts.

ICE CURRENT

hese few figures should suffice to w how meaningless it is to talk of dspeaker watts by merely consider voltage and rated impedance.

enerally speaking, however, we are concerned with the actual power orbed by the loudspeaker, but by the e-coil current in the moving-coil and the voltage across the plates he electrostatic type. Thus we strive to keep the impedance from rising in the case of the moving-coil and from falling in the case of the electrostatic. With typical contrariness, nature opposes our efforts.

Here ends the first lesson by Mr Cooke.

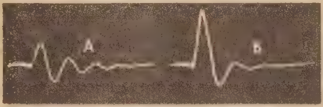

Fig. 5 — Shock tests show effect of magnet. (A) A 10-inch loudspeaker unit with a 10,000-gauss magnet. (B) Same as for part A but with a 14,000-gauss magnet.

TRANSIENTS & RESONANCE

These qualities are taken together because one is dependent on the other. Absence of resonance (or ringing) **ipso facto** results in good transient response provided a sufficiently wide frequency range is covered.

The basic difference between a loudspeaker and a musical instrument is that in the one all resonance should, in theory, be avoided like the plague, whereas in the other maximum resonance is the objective.

Piano makers strain at the leash to increase the effectiveness of the soundboard or resonator, but the worst loudspeaker I ever heard was the result of fixing a moving-coil driver to a point on the soundboard of a piano. (It is impossible to make speakers for 25 years without trying a few silly ideas.)

The main resonances in a moving-coil unit are due to (a) fundamental cone resonance; (b) cone break up; (c) surround resonance; and (d) resonance of spider or centering device.

In so far as the electrostatic speaker avoids these pitfalls it can be said to have a better transient response, but it must not be assumed that moving-coil design remains stagnant. The main cone resonance is virtually damped out by the modern amplifier and by high flux density in the magnet. The effects of cone texture in large speakers, and stiffer diaphragms in small units. Surround resonance is avoided by using soft cloth of foam plastic surrounds or by completely free suspension.

CENTRING

The centering device is still a necessary evil with moving-coils, but its resonance is the least objectionable of those cited. In small units limited to frequencies above 1,000 cycles, the conventional spider or corrugated disc can be dispensed with and the coil can be

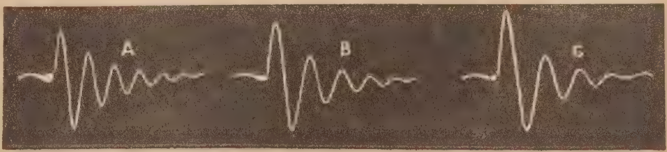

Fig. 6 — Shock tests showing the effect of various cone suspensions. (A) A 10-inch unit with corrugated cone surround. (B) Same unit with cloth and (C) foam surround.

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PF164	230-240	325-0-325	100	6.3V-2AC.T., 6.3V-2A, 5V-2A
PF160	230-240	385-0-385	100	6.3V-2.5AC.T., 6.3V-2A, 5V-2A
PF1072	230-240	300-0-300	120	6.3V-4AC.T., 6.3V TAP 5V-2A
PF152	230-240	285-0-285	125	6.3V-3AC.T., 6.3V-2A, 5V-2A
PF163	230-240	325-0-325	125	6.3V-2.5AC.T., 6.3V-2A, 5V-2A
PF181	230-240	385-0-385	125	6.3V-3AC.T., 6.3V-3A, 5V-2A
PF174	230-240	285-0-285	150	6.3V-2AC.T., 6.3V-3A, 5V-3A
PF142	230-240	325-0-325	150	6.3V-2AC.T., 6.3V-2A, 5V-3A
PF175	230-240	385-0-385	150	6.3V-2AC.T., 6.3V-2A, 5V-3A
PF173	230-240	425-0-425	175	6.3V-3AC.T., 6.3V-2A, 5V-3A
PF1067	230-240	400-0-400	180	6.3V-4AC.T., 6.3V-2.5AC.T., 5V-3A
PF1193	200-220-240	295-0-295	275	6.3V TAP 5V-3A, 6.3V-9A
PF1265	240	—	—	6.3V-2.25A
PF162	240	—	—	6.3V-3A, 6.3V-3A
PF265	230-240	—	—	17V. TAPS 11.5V, 10V, 8.5V-4.2A

★ *L.T. windings now amended for use with either 5V or 6.3V rectifier.*

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d in centre with a simple cloth disc
ich is entirely resonance-free. (We
pted this arrangement on a 3in unit
eral years ago with complete success.)
There can be little doubt that a really
fect loudspeaker would be massless.
e "Ionophone," as it is known in
gland, seems to be the nearest ap-
ach to date, but its development has
n bedevilled by distortion troubles
all the old problems of horn load-
, plus radiation which interferes with
reception within a small area, prob-
y not exceeding a radius of 50 feet.
The diaphragm in a moving-coil
aker is receiving shock after shock
it is this state of affairs which
ours the reproduction.

Pictures of the effect of shock treat-
nt are therefore not without interest,
a few are reproduced in Fig. 4.
voice coil is held off its central
ition by applying a suitable value
direct current.

When the circuit is interrupted the
ce coil moves and the e.m.f. gener-
d in it as the vibrating coil cuts the
gnetic field operates the oscilloscope
the triggered time base, the result
ng photographed.

n all cases shown in Fig. 4, wider
cing between vibration peaks indi-
es a lower resonance frequency of
cone. The benefits of high flux den-
, non-resonant surrounds, and free
pension with low cone resonance are
arly shown. The cone assembly in ex-
ples A and D is obviously behaving
a drum and is typical of the cheap,
ss-produced speaker.

OTO TESTS

The tests just described were made
ut five years ago. This (or any
er) method of photographing what
es place always appeals to me strong-
because the results are theory-free
. enduring. Given an accurate state-
nt of conditions of test and a care-
y considered interpretation, the find-
s will be as true in a hundred, or
n a thousand, years as they are today.

Quite recent tests on 10 inch units
shown in Figs. 5 and 6 and again
firm the virtues of soft surround and
h flux density.

The results shown in Fig. 6 speak
themselves.

t will be seen from Fig. 5 that with
same input voltage and identical cone
coil assembly the deflection of the
ce coil is almost three times as great
n the higher magnetic flux, but the
comes to rest with half the number
oscillations. Translated into speaker
formance, this means much higher
sitivity (or fewer watts from the am-
ier) plus cleaner reproduction and
erior transient response. In fact, the
ues of high flux density—or in other
ds expensive magnets—are beyond
ute and are confirmed by the most
nitive listening test.

To be continued)

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H4 (Record-play) and EH4 (Erase) Miniatures	£5 2 0

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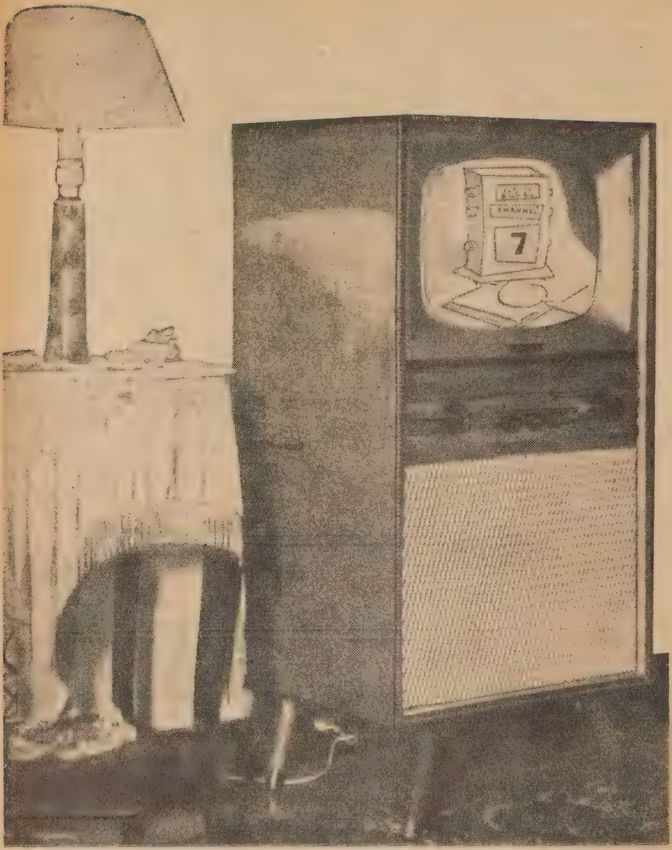


Here is the complete console cabinet which our contributor built to house the 17-inch TV Receiver. It is proportioned to bring the centre of the screen to eye level, when seated on conventional lounge furniture. The height can be reduced, however, without changing the basic design concept of the cabinet.

Console Cabinet For Your T

Here is a console style cabinet design suitable for TV SETS with chassis-mounted picture tubes. It can be built cheaply without any special skill or special tools and should be completed in one weekend. While the measurements relate to our 17-inch version, there is nc reason why they cannot be modified to suit the 21-inch set.

In July, 1957, the construction of a modern-style cabinet for a 17-inch television receiver was described.

This was primarily intended for sets using cabinet mounting for the picture tube, a home-constructed picture mask playing the dual role of supporting the tube as well as framing the picture.

Many readers, alternatively, have decided to mount the picture tube on the chassis itself, as for the 21-inch version. Full details of such mounting can be found in the December, 1957, issue.

With the release, in fair quantity, of moulded plastic picture masks, the method of mounting the picture tube on the chassis has gained considerably in popularity and, in no small manner, simplifies the construction of the cabinet.

We decided that the cabinet produced should be of the utmost simplicity so that it could be duplicated by anyone using the humblest of equipment. With that object in mind, the writer limited himself to the tools most likely to be found in the average handyman's home—hammer, panel saw, small plane and punch, and screwdriver.

Some panel pins, screws, sand-paper, wood glue and filler are the only other accessories required.

By COLIN JONES

Most TV receivers on the market day are somewhat small in stature ar as a result, sales are gradually increasi of "TV stools" and "TV cushions," r to mention the low "TV lounge suite

As it costs quite a small fortune th days to re-furnish a complete room suit just one piece of furniture, we cided to take the opposite approach.

It was envisaged that the set wo stand in a "standard" domestic lou setting and to get the "correct" level the TV screen, the writer sat in one the chairs in a relaxed position and dr ped a tape measure from eye level the floor.

CHECK ON HEIGHT

This distance was taken to repres the height, from ground level, of centre of the screen, in our case, inches. So, we have the basic measu ment of a tailored-to-measure televis receiver.

Whether you care to follow method, however, is a matter of sonal choice, and you may vary dimensions from the shelf level to floor to suit your own requirements.

We reversed the procedure with cabinet by building it to fit the saf glass instead of the other way rou This was because sheets of this spe glass have been made available, althou at this stage, not in large quantit ready-cut to fit either 17in or 21in set

In our case the dimensions of the g are 19¼in by 14in. We would ad intending constructors to endeavour obtain such a sheet before building cabinet as the careful use of it du construction will assist considerably "squaring up" the cabinet.

In order to keep the cost of this ca net to a minimum, we decided to re the depth to 18in, building a small on the back coverplate to protect end of the picture tube which pro beyond the back edge of the chas This is in line with many comme models on the market today.

To enhance its appearance, we chased a set of small round tapered some 6in long. This meant that, in o to have the centre of the screen at

SIMPLE CONSTRUCTION SUITS BOTH TUBE SIZES

viously determined height, the wood-rk (ignoring the legs) would have to 36in long.

This proved to be the ideal measure-nt because it was found that the ½in wood is available, ready-cut to these nensions.

The accompanying diagram shows the nensions of the original cabinet and manner in which the various pieces put together. Two 3ft lengths of ply-od were carefully chosen, making sure it they were free from defects, and se were lightly planed along their ges.

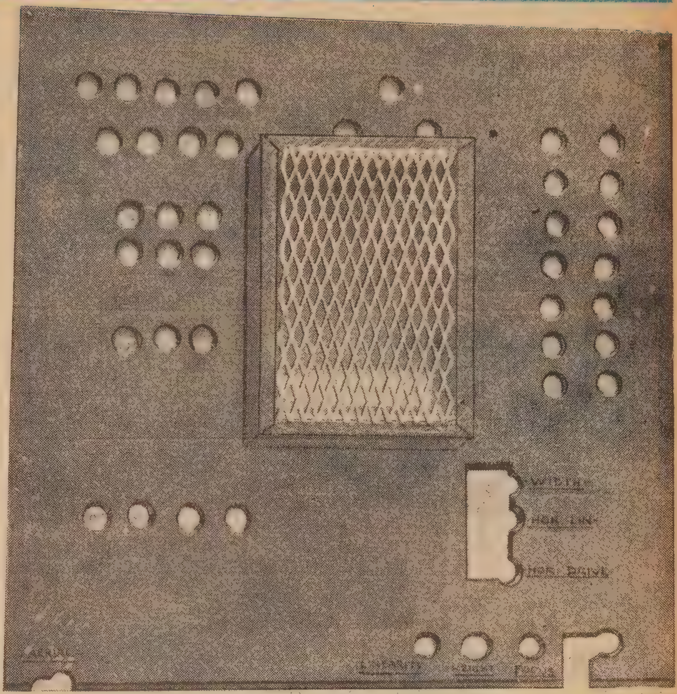
When planing edges such as these, it imperative that you work from both ds toward the centre to avoid the risk chipping the corners. Three more gths of plywood are required for the , shelf and bottom of the cabinet, nensions of which are outlined in the gram.

UARD AGAINST SCRATCHES

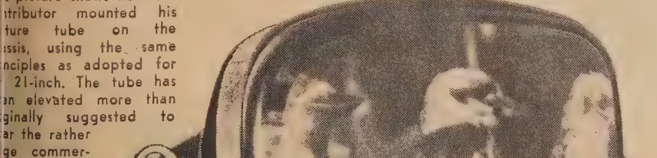
It is a good idea to spread a bag or on the floor of the workshop to vent the surface of the ply from ing damaged or soiled during construc-n.

Cut four cleats from either 1in square "quad" dressed stock and drill three les through them each way and intersink. These are used to strengthen butt joints between the sides and the and bottom.

To assemble, commence with the bot-n panel and coat the relevant surfaces h some casein or other carpenter's e. Secure the sides to the bottom driving half a dozen long panel pins ough each side, punching the heads ow the surface for subsequent filling.



An important part of the cabinet is this rear cover which protects the internal "works" and particularly the end of the picture tube, while permitting some ventilation. Note the access holes for the picture adjustments.



s picture shows how our ntributor mounted his ture tube on the ssis, using the same nciples as adopted for 21-inch. The tube has en elevated more than ginally suggested to ar the rather ge commer-l tuner which he fitted.

Stand the now partly assembled cabinet on its base and secure the top to the sides, using the same procedure as before. Now coat the cleats and internal surfaces of the joints with glue and screw the cleats firmly into position, making sure that the screws are long enough to hold the two surfaces strongly together, yet not too long, where they would penetrate the top or sides and ruin the surface.

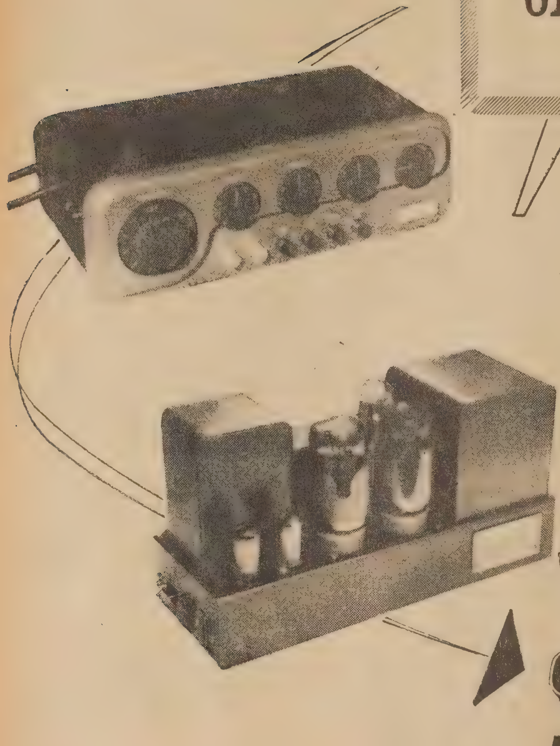
Note that the cleats should end approximately 1½ inches from the front of the cabinet and are flush with the back. This will allow the safety glass and speaker baffle to be positioned later from the rear.

Test the unit now for squareness using either a T-square or the safety glass, then nail several short lengths of timber or aluminium moulding across all corners at the front and back to ensure that the "squareness" of the cabinet is maintained during subsequent operations. These are removed later on.

To hold the safety glass and expanded aluminium speaker grill in position, ½in picture framing is used. Select the type of moulding which has the side at right angles to the back otherwise difficulty will be experienced in attaching it to the cabinet.

This is cut to the dimensions shown and fastened with glue and panel pins (through the edge on which the glass will stand) to the inner front edge of the cabinet so that the outer edge of the

for the closest approach to the original sound



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ne is flush with the outer edge of the inet.

The safety glass can now be tested inst the back of the frame to ensure everything is in order.

Vith the glass held in the position it eventually occupy, place a pencil rk on the cabinet frame at the bot- of the glass and then put the glass ly to avoid accidental damage.

ONTROL PANEL

he control panel used in this parti- ır set was a short length of pre-shaped met moulding, ½in at its greatest thick- s and six inches wide.

his is cut to fit behind the "picture- ne", the edges being filed flat to fit l into the frame. The top of the trol panel is planed down to fit into bottom edge of a piece of aluminium ulding, or "H" cross-section, the safety ss and plastic picture mask resting ether in the top of the "H."

The thickness of the glass and plastic nbined is slightly more than the space wed by the aluminium so that the CK of the moulding has to be opened a little with a pair of pliers, but be y careful not to deform the front of aluminium when doing this.

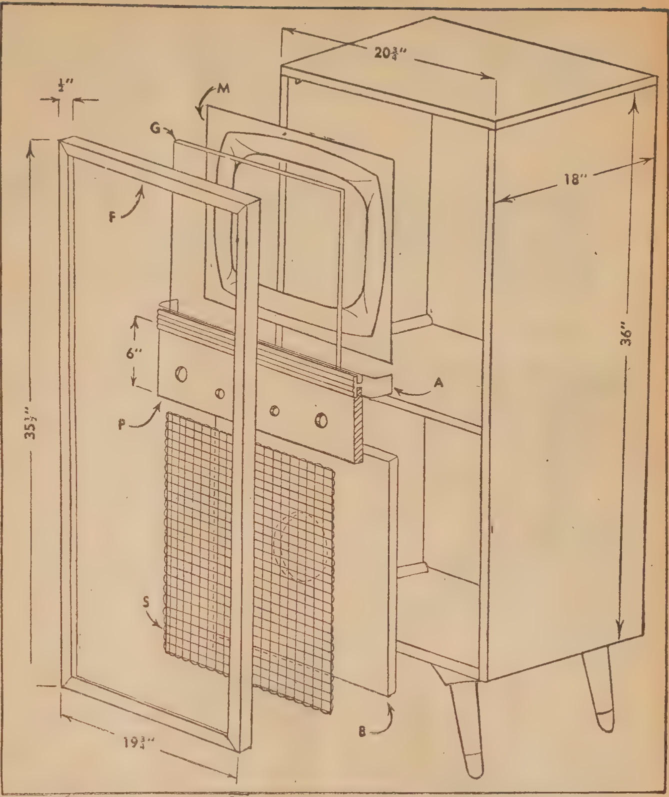
Vhen cutting the aluminium mould- to size, allow about 1in on each end bend at right angles for attachment the inner sides of the cabinet.

he panel is then drilled for the holes the control spindles, allowing suffi- nt distance for the picture tube and untings to clear the tuner and tops valves or other components on the ssis.

Fasten the panel with glue and panel s into position inside the cabinet and ew the aluminium to the sides. Two nch lengths of ¾-inch quad are glued l screwed into the cabinet at each end the panel for extra support.

The shelf is the next item to secure l this is made to fit approximately inches between the centres of the ntrol spindle holes (depending on your n layout) where it is fastened to the es by glue, panel pins at various les, and two lengths of 1-inch stock neath it for support, these lengths ing 1½-inches from the front. Two nel pins and a screw through the con- panel into the shelf will stop any ay" in this direction.

The holes in the panel are covered a short length (5-inches) of picture me moulding on which are inscribed various functions of the three smaller ntrols.



Here are the assembly plans for the console TV cabinet. Some details have been exaggerated for clarity. Key to the diagram is as follows: A, aluminium moulding B, speaker baffle; F, frame moulding; G, safety glass; M, picture mask; P, control panel; S, expanded aluminium speaker grille.

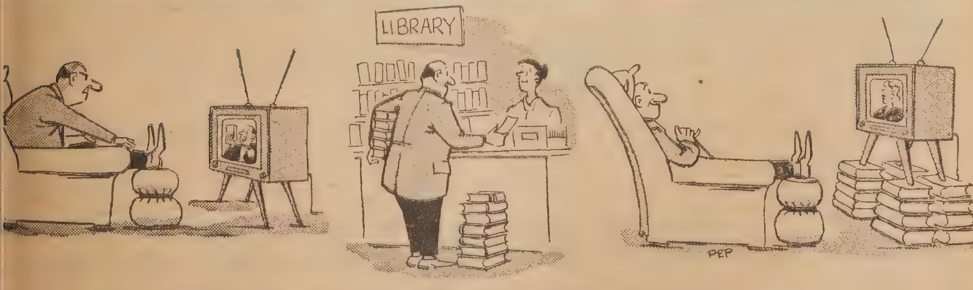
The plastic picture mask can now be carefully cut to fit snugly in the cabinet, resting in the aluminium moulding and holding the glass within the frame. Note that the picture mask is cut ½-inch wider than the glass on all sides except the bottom. Two pieces of ¾-inch dressed quad screwed (not glued) behind the mask to the sides of the cabinet is all that is required to hold the glass and mask in position.

When all is in order in this section of the cabinet, take the mask and glass out of the cabinet and remove the angle strips that had been pinned in place to hold the cabinet "square."

Because of the thickness of the frame moulding and the control panel, the chassis will project beyond the back of the cabinet by almost ½-inch.

To overcome the difficulty in positioning the back cover plate and at the same

(Continued on Page 117)



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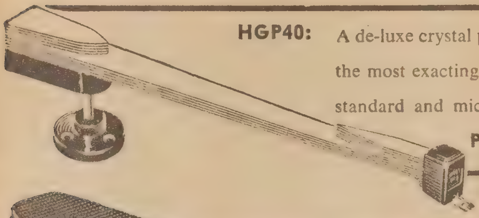

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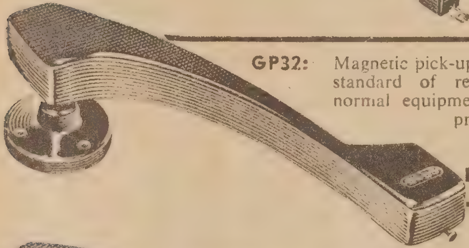

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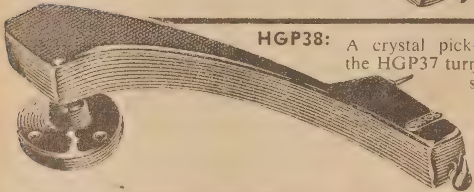

HGP38: A crystal pick-up. Incorporates the HGP37 turnover cartridge for standard or microgroove recordings with cantilever stylus.

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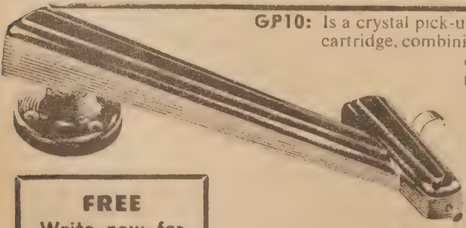

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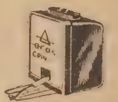

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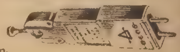

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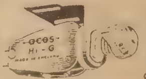

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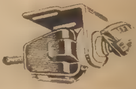

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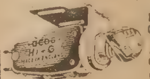

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HOW TO GET YOUR AMATEUR LICENCE

In last month's issue we detailed the requirements for obtaining an amateur transmitting icence, and told you how to make preliminary applications This month we are concerned specifically with the technical examination, thy application. This month we are concerned

fter some months of study, you fin- face the great moment. You feel your knowledge is sufficient to en- you to pass. But will you miss out ply because you didn't tackle the er in the most efficient way?

very student knows the importance "examination technique," and while can't pass unless you know your k, the way you tackle the paper can ke a big difference to the ease with ch you do it.

lost important is the matter of read- the instructions at the top of the er and noting **exactly** what is re- ed.

NLY 7 ANSWERS NEEDED

you read the heading at the top the October 1957 paper given here, will see that you are asked to do en of the nine questions listed. You n't get any extra marks for doing nt questions. You would probably n fewer marks, because the time ted on the extra question may have n better spent on gaining more marks the questions which count.

t the other extreme, you have to at- pt at least five questions in order to s. But if you did five questions only, would have to gain practically full rks for each, which is unlikely. Six stions answered are necessary for a sonable chance of getting through.

he best approach, is to aim at seven stions, and even if you don't know reat deal about one of them you have hance of gaining at least a few extra rks by making an attempt.

nowing that you have 2½ hours, you allow yourself 20 minutes for each stion. Try to keep closely to this edule. Watch the time, and check you finish each question to see whether are ahead or behind schedule. Un- you are really smart, it is most likely be the latter.

RDER OF WORKING

f you know your work reasonably ll, you will find two or three questions ich can be answered without hesita- n. Do these first. They are marks "in bag" and there is an incalculable chological advantage in knowing that much of the paper is behind you.

Handle your best questions carefully. meticulous about numbering each, ether with its separate parts, especially en you are working through them in order other than that of the paper. u should be able to complete them in ittle less than the allowed 20 minutes, ging yourself extra time to think about tougher ones.

Answer the question. If it asks for a gram of the voltage distribution on feeders of a particular type of aerial, n't write a treatise on transmission es. Perhaps you are an expert on subject, but it won't earn you any ra marks in this case—it may even se you to fail.

If the question asks for typical circuit values, don't forget to include them. The examiner probably allots a proportion of marks for each section of each question. If you miss out on something he definitely asks, he simply can't credit you with the marks, no matter how much you write about the rest of the question.

BLOCK DIAGRAMS

There are some questions where a block diagram tends to help your own thinking although not strictly necessary to the answer. If you were asked to show the essential stages of a superhet receiver and explain what each does, a block diagram would help. It would not be necessary to draw a complete circuit.

Suppose that, after 1¾ hours, you have two questions to go. In one case you can answer most of what is asked, but of the three remaining untouched questions in the paper the best offers faint hope.

This is a case when the correct decision could gain you just enough marks to get over the pass line. It may even be best to write something on the really tough one first and earn at least a small proportion of the marks. You could then go back and dig into the one you think likely to gain you the more marks for the remainder of the time.

Of course, it's best to be so sure of your work that you can answer seven questions fully. But sometimes luck is not with the best of us and the examiner just doesn't ask the questions we have studied.

If you check through a few past examination papers you will find that there is a sameness about the questions. This is because they are designed to test your knowledge of certain aspects of radio, and there is a limit to the variety of questions which can fairly be asked. With some judicious guessing you can often approximate the questions which will appear in the next paper.

At any rate, here are the answers which we feel would earn high marks for the October, 1957, paper. We have set them out just as you would in answering the paper yourself.

* * *

QUESTION 1: Key clicks are caused by transient voltages set up in the transmitter each time the contacts of the transmitting key make and break the keyed circuit. These transients represent a wide band of frequencies which may be radiated by the aerial and/or the power mains to interfere with other services. They may be eliminated by connecting suitable components in the keying circuit to delay

A.O.C.P. THEORY TEST, OCTOBER, 1957

SEVEN QUESTIONS TO BE ATTEMPTED—EQUAL MARKS FOR EACH

1. What causes "Key Clicks"? Describe, with the aid of diagram, how this type of interference to broadcast reception may be reduced or eliminated.

2. (a) Explain, using sketches, two methods of matching a half wave centre fed aerial to a transmission line. Show the current and voltage distribution.

(b) Why is it important to correctly match line to aerial impedance? What effects can result from mismatching?

3. Having a zero to 1 milliampere meter with internal resistance of 100 ohms describe how you would adapt this instrument to read the following:—

(i) up to 500 volts d.c.:
(ii) up to 100 milliamperes d.c.

Show component values in both cases.

4. What do you understand by the following definitions relating to Frequency Modulation:—

(i) Modulation Index, (ii) Deviation Ratio, (iii) Frequency Deviation
(iv) Frequency Swing?

5. (a) Draw circuits of a crystal oscillator and a variable frequency oscillator capable of being used by an amateur station.

(b) Explain the theory of operation of each type and state what particular advantage and disdvantage each possesses.

6. What are lecher wires? Describe, with the aid of a diagram how you would use these to measure the frequency of a transmitter operating on 144 megacycles.

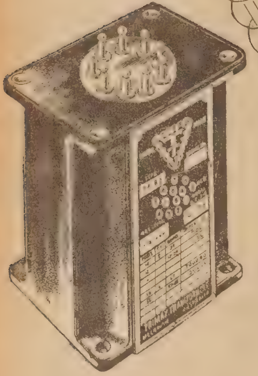
7. (a) Using diagrams, explain the principle of operation of a crystal microphone. Show how you would connect this to the input of a microphone amplifier. Give resistance values.

(b) Why is it necessary to carefully shield the microphone leads and transformer used with a moving coil or ribbon microphone?

8. Explain with the aid of a diagram how high tension supplies for a receiver or a transmitter may be obtained from a battery and a vibrator.

9. What do you understand by the following terms used in ionospheric investigations:—

(i) Critical Frequency. (ii) Maximum Usable Frequency. (iii) Optimum Working Frequency. (iv) Sporadic E. Layer.



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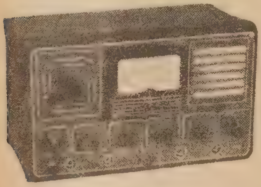

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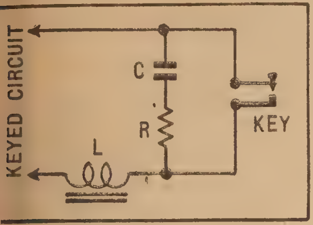
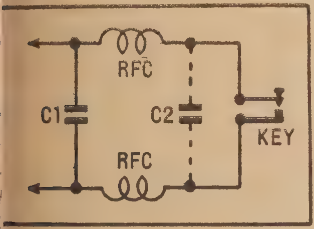
he rate at which voltages and currents ise and fall in this circuit as the transmitter is keyed.

The diagram of a typical key-click filter s shown herewith.



Q1 — Diagram of typical key-click filter.

In this diagram, the inductor L delays he rise of current as the key is depressed, and the capacitor C delays the ise in voltage as the key is opened. Resistor R, a peak current limiting resistor, prevents an arc at the key contacts vhen these are closed, discharging apacitor C.



Q1 — Simple filter to reduce radiation due to sparking at key contacts.

Radiation due to sparking at the key ontacts can also cause interference to earby broadcast receivers. The interference can usually be eliminated by onnecting a filter using a pair of RF hokes and a small capacitor right at the ey terminals in accordance with the ircuit given. A second capacitor C2 is ometimes included.

Exact values in these diagrams are enerally determined by experiment.

★ ★ ★

QUESTION 2 (i): The impedance ooking into the centre of a half-wave erial in free space is approximately 72 hms. It may be fed by breaking such n aerial at its centre (with an insulator) nd connecting any length of 72 ohm alanced cable to the ends of the wires. n practice, co-axial cable can also be sed without serious unbalance effect if ne aerial is reasonably high.

(ii) Any constant impedance line may e used to feed a half-wave aerial at the entre if the line is an electrical halfwavelength long. The impedance presented at the transmitter end will also be 2 ohms because the half-wavelength is a -1 ratio transformer. The feed line ay therefore be any number of halfavelengths, and its characteristic impedance within reason is not important.

(b) A correctly matched feed line is nportant to ensure the most efficient ansfer of power from the transmitter the aerial. Mismatching will cause eflections along the line. These will set p standing waves which cause points of igh and low voltage and current values to appear. High voltage can cause losses at points of insulation and high current can cause losses due to the resistance of the feeders. Standing waves can also cause losses due to radiation of energy from the transmission line.

★ ★ ★

QUESTION 3—(i): The meter can be used as a voltmeter reading 500 volts full scale deflection by wiring a resistor in series with the movement. The total resistance must be such that 1 milliamp flows with 500 volts applied. By Ohm's Law, the value of this resistor will be equal to the voltage, 500, divided by the current flow, .001 amps. This works out to 500,000 ohms.

Subtracting the meter resistance, the required multiplier is 499,900 ohms. In practice 500,000 ohms would be near enough.

(ii) A resistor can be connected in parallel with the meter movement to allow it to measure 100 mA on full scale deflection. The value of the resistor must be such that, with 1 mA passing through the meter, 99 mA pass through the shunt. This value is equal to 1-99th the meter resistance. The meter resistance is 100 ohms. Therefore the required shunt is 100 x 1-99 equals 1.01 ohms.

★ ★ ★

QUESTION 4 (i): The Modulation Index is the ratio of the carrier frequency deviation to a specific modulating frequency.

(ii) The Deviation Ratio is the ratio of the maximum carrier frequency deviation to the highest modulating frequency.

(ii) The Frequency Deviation is the maximum change in frequency from the carrier frequency during modulation.

(iv) The Frequency Swing is the total change in frequency during modulation and is equal to twice the Frequency Deviation.

★ ★ ★

QUESTION 5:

(a) See circuit diagrams.

(b) CRYSTAL OSCILLATOR.

In the circuit of the crystal oscillator shown, the crystal (x) is the equivalent of a high-Q parallel tuned circuit. The circuit L1C1 connected to the plate of the valve is tuned to a frequency slightly higher than the crystal frequency. Energy having an in-phase component is fed to the grid from the plate of the valve via the inter-electrode capacitance C2. If the gain of the valve is high enough for the feedback energy to overcome circuit losses, the circuit will oscillate at the parallel resonant frequency of the crystal.

The oscillating frequency is determined by the size and orientation of the quartz crystal, which physically vibrates when the circuit oscillates. The crystal is generally mounted between two metal plates, often with an air gap. Output may be taken from the plate via a small capacitor or coupled inductively from coil L.

Advantages:

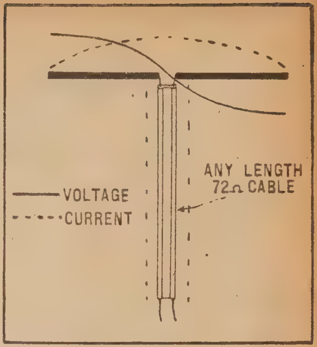
(a) The circuit arrangement is very simple.

(b) Stability of oscillation is very good, affected only slightly by variations in circuit constant and supply voltage.

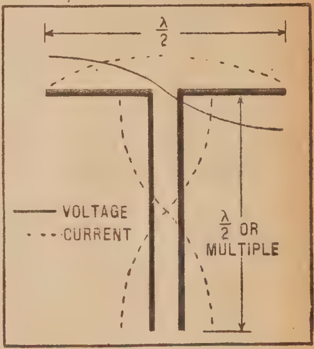
Disadvantages:

(a) Not suitable for variable frequency operation without multiple crystals.

(b) Crystal can be shattered by high crystal current if incorrectly adjusted.

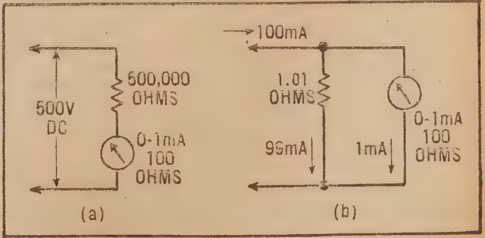


Q2 — Half-wave aerial fed with 72 ohm line



Q2 — Half-wave aerial fed with length of constant impedance cable in multiples of half-wave length.

Q3 — (a) Use of multiplier to convert meter circuit to read 500 volts. (b) Use of shunt resistor to convert to read 100 milliamps.



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Part of the grid coil is included in the hode-ground circuit. As this portion the coil is common to both grid and een circuit, an in-phase component l be fed from the screen to the grid. e circuit will oscillate when this com- ent and the amplification of the valve sufficent to overcome circuit losses. e flow of grid current which takes ce when the grid is positive with re- ct to the cathode builds up a negative rge at the grid to provide automatic l bias.

The grid capacitor C2 avoids short- cuiting the grid to the cathode through coil. The oscillation frequency is by the values of L and C1 plus stray cuit values.

Output may be taken from the plate the valve which is coupled to the os- ator through the common electron am. The RF choke is the plate load. he valve has a suppressor, this should earthed.

vantages:

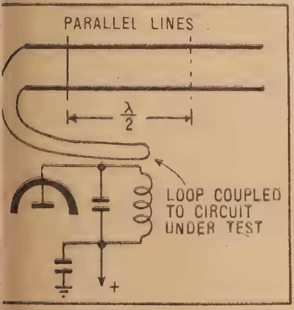
a) The circuit may be set to any fre- ncy within the tuning range of L and

b) Generally cheaper than a crystal illator with multiple crystals.

sadvantages:

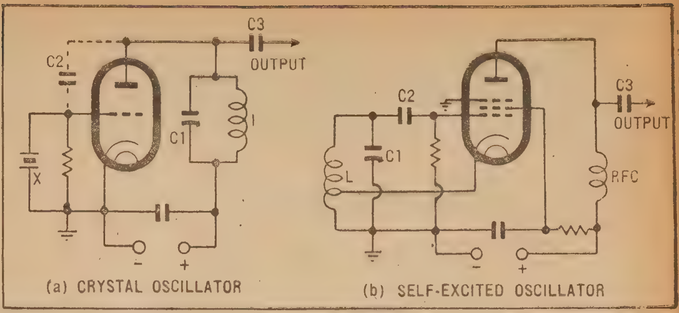
a) Physical or electrical variation of components or surrounding objects y cause unwanted variations in fre- ncy. A high-C circuit is desirable..

b) Variations in supply voltages may se appreciable variations in frequency



6 — How Lecher lines are connected an RF output stage to measure frequency.

QUESTION 6: A two-wire parallel nsmission line used to measure dir- y the length of radio waves particu- y at ultra-high frequencies is said to sist of Lecher wires. In use, they loosely coupled at one end to the put stage of a transmitter tuned to onance. When energised, a shorting containing an indicating device is along the wires to indicate successive nts of high voltage or current. The ance between successive points of ier represents quite accurately a half- velength of the frequency being mea- ed. The indicating device may be an ammeter, RF voltmeter, or even a all torch globe to indicate by its bril- nce successive repeat points. If the f-wavelength in inches is divided into 5, the result is the frequency in gacycles



Q5 — (a) Circuit of a simple crystal oscillator. (b) Circuit of a simple self-excited oscillator.

QUESTION 7: The crystal microphone operates by virtue of "piezo-electric effect." This phenomenon produces potential differences on opposite side of slabs of certain crystals, notably Rochelle salt, when these are subjected to mechanical strains.

In the diaphragm type crystal microphone, a square slab crystal is supported at three corners but the remaining corner is connected to a diaphragm. When the sound waves cause the diaphragm to move, the crystal is subject to minute mechanical strains and potentials in sympathy with the original sound are developed.

Connections to the external circuit are made via conducting layers fastened to opposite surfaces of the crystal and leads connected to them.

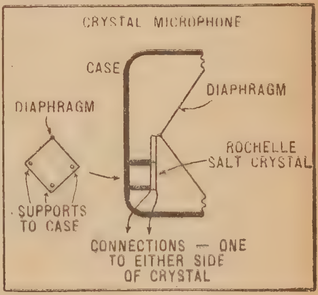
Being a high impedance device, the microphone is generally connected into the grid circuit of a valve with a load resistor of from 2 to 5 megohms or as specified by the manufacturer. A blocking capacitor is desirable in the active lead to prevent any DC voltage appearing across the element.

(b) Shielding is desirable around connecting leads and coupling transformers of ribbon or moving coil microphones in order to prevent hum pickup from external electric fields. It is also effective in avoiding RF feedback.

Hum due to electric fields may be removed from the leads by enclosing them in copper braid

The microphone transformers, and certain low impedance leads, may pick up hum due to magnetic coupling. This can be avoided by surrounding the affected parts with magnetic material. High permeability iron such as Mu-metal or Permalloy is frequently used.

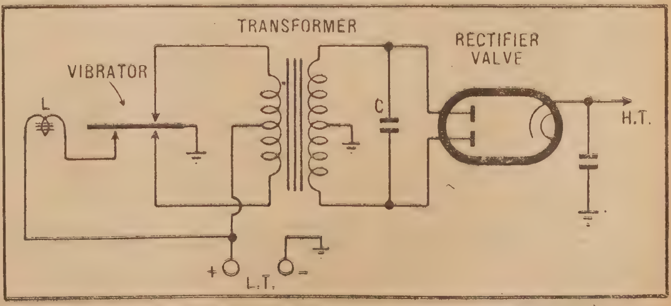
QUESTION 8: A vibrator is used to interrupt and reverse the direction of the primary current of a transformer. It thus supplies the changing magnetic field needed for transformer action and the initial low voltage DC supply can be stepped up to a high voltage alternating current. The alternating current is applied to a rectifier which delivers pulsating DC to a filter circuit. Alternatively, an additional set of contacts, synchronised with the primary contacts, can be used in place of the rectifier. Action is initiated by a starting coil L and its contact. Vibrator design may vary on this point.



Q7 — Diagram of a diaphragm type crystal microphone.

The capacitor C is chosen to resonate the transformer at the natural frequency of the vibrator. This has the effect of reducing sparking at the vibrator contacts and reducing current drain. In a practical transmitter supply, a high fre-

(Continued on Page 77)



Q8 — Diagram of a vibrator power supply using a rectifie

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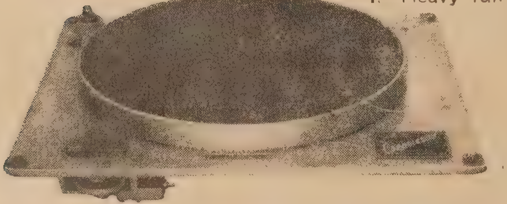

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FROM THE SERVICEMAN WHO TELLS

At various times in the past, I have read and told stories about faulty coupling capacitors and here's another one with a different slant. It might possibly provide a lead for someone else who has come up against the same set of symptoms.

OF course, by introducing the story this way, I have been guilty of the same thing as many womenfolk who say, typically: "Dear, tell Mrs So-and-So the story about the window that you couldn't see through because it was so dirty."

Having thus identified the joke by its "punch line," no amount of artistry thereafter in the telling can make it funny. Nor is it funny either, if you refuse to tell it.

Well, as I said, this is a story about a coupling capacitor.

It started one day, when I received a call from a very good friend who could variously be described as a "Hi-Fi Crank" or an "Audiophile." He isn't in the game professionally but has picked up a good deal of knowledge from long association with amplifiers.

Quite perturbed, he told me that his amplifier seemed to be on the fringe of motor-boating but nothing he could do would cure it.

NO CURE!

Every time he moved the volume control too rapidly, the speaker would emit a double "plop-plop" sound. This was unpleasant in itself but he was worried that such near-instability would "mess up" the low frequency reproduction.

"Sounds like electrolytic trouble," I said. "Have you tried new ones in parallel, or extra decoupling?"

He gave me a somewhat disgusted look, apparently for making such an obvious suggestion.

"Listen mate, I've put so many electros into the thing, they're hangin' out the bottom. They don't make a scrap of difference."

"Has the amplifier always been like this?"

My friend said not—or at least he didn't think so—although the recent substitution of a low output pickup meant that the volume control was now used over a wider sweep than formerly. The effect could conceivably have been present earlier without his noticing it.

"What about the coupling capacitors in the control unit?" I asked. "Some of these overseas capacitors aren't so hot, you know."

He said he'd checked these and they seemed to be okay.

TV ELECTROLYTICS

"Have you tried bigger electros? I see the R, T and H boys are suggesting TV types for amplifiers . . . 50 and 100 mics."

Again that look of disgust, or something. Apparently he had tried them.

"Then what about high frequency instability? Have you changed your speaker set-up lately? Some amplifiers will oscillate with long leads or filters connected to their output circuits."

Again I drew a blank. My friend said he had no C.R.O. but a multimeter on the 10-volt AC scale, and connected across the voice coil winding, showed no deflection without signal. No, he didn't think the amplifier was oscillating.

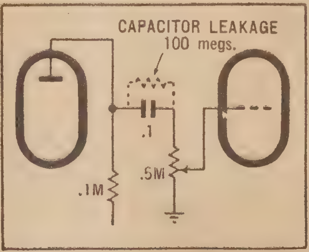
Since there appeared to be nothing else for it, I suggested that he bring the amplifier and control unit over the following evening and we could run through it on the test bench. This he did.

When duly connected up to the bench speaker, it looked very much as if the amplifier was going to play the familiar trick of behaving itself, under observation. Swinging the volume control gave no plop-plop effects whatever.

COULD BE FELT

Leastwise, it didn't seem to, until I touched the speaker cone with a finger tip. I could then feel the plop-plop without hearing it, which seems to point to some moral about bass response in test-bench speakers.

However, not wanting to spend the rest of the evening with one finger on the cone of a speaker, I connected the C.R.O. across the output and tried again.



When an output valve cathode resistor open circuits, the bypass electrolytic may open circuit or break down. In this rare case it almost tricked the serviceman by developing enough leakage to maintain about the correct bias for the valve.

This time, the effect was quite evident as a slight up-and-down movement of the C.R.O. pattern.

At least we had something to work on.

What about the feedback factor? Perhaps it was too high. Possibly a resistor had drifted in value.

To check this, I duly connected my output meter across the voice coil leads and set it to 10 volts AC. Then, feeding a signal through the amplifier, I shorted out the feedback circuit and set the control to give an output of 10 volts across a 15-ohm resistor, which incidentally, I had substituted for the speaker voice coil.

There's no point in blasting one's ears, if you don't have to.

At the same time, a quick glance at the C.R.O. pattern showed me that the amplifier was not being overloaded with 10 volts across the load.

On removing the short, the output voltage dropped to 1-volt, indicating 10 times gain reduction or 20db of feedback. Without knowing what the exact figure should be, it was at least a likely one. Nor was there any sign of instability in the C.R.O. pattern, with or without signal.

What then? I checked through things in my mind.

Electrolytics apparently OK! Decoupling more than adequate by all appearances. Feedback factor high but not suspiciously so. No sign of high frequency instability.

What about those coupling capacitors? Ignoring my friends' protestations, I stripped the control unit from its cover and identified the coupling capacitor between the pickup preamp. stage and the gain control.

On one side, the plate voltage was evident, on the other side, nothing. Or was it nothing?

Peering in myopic fashion at the meter needle, I detected just a trace of forward movement as the test prod touched the grid side of the capacitor.

DEFINITE LEAKAGE

It didn't take long after that to strip the capacitor out and check it on the V.T.V.M. Leakage resistance . . . 100 megohms.

That's a lot of megohms but not enough for a coupling capacitor. Assuming a 0.5 meg. potentiometer, it means that 1/200th part of the plate voltage is present across the volume control. And 1/200th part of 100 odd volts is 0.5 volt.

Therefore, swinging the volume control through its travel with no signal applied, would put a voltage on the grid varying from 0 to 0.5 volt at an apparent frequency determined by the rate of rotation of the pot.

In a system which is probably flat down to a few cycles per second, a low frequency impulse of near "overload" proportions, fed right through the amplifier, could so disturb the voltage levels that the poor thing could hardly be blamed for giving a couple of plops in the process of recovering.

As I had hoped, a new coupling capacitor (600-volt type this time) wiped the trouble like magic.

PRECAUTIONARY STEP

But here's the unkind cut.

My friend revealed that he had replaced the "overseas" coupling capacitors some time previously as a purely precautionary measure. The one which had now developed leakage and caused him so much heartache was very much Australian made.

Who said hooray for direct coupling?

My second story for the month is only

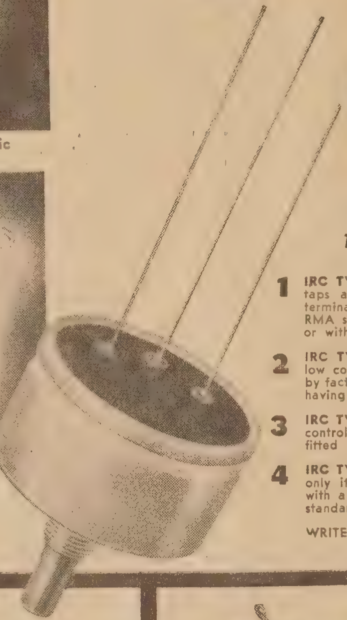
4 NEW VOLUME CONTROLS ADDED BY . . .

IRC

AUSTRALIA

to their unexcelled range!

IRC Type Q Concentric Control



Above: IRC Type EC Tab-mounted Trimmer or Preset Control. At right: IRC Type Z Volume Control & Type ZW Rheostat Potentiometer.

1 **IRC TYPE Q CONCENTRIC DUAL CONTROL.** Available with or without taps and switches. Panel and rear sections can be oriented so centre terminals are located at any multiple of 15° from each other. Standard RMA shaft dimensions with or without slots 180° apart in outer shaft. with or without flat or slot in outer shaft

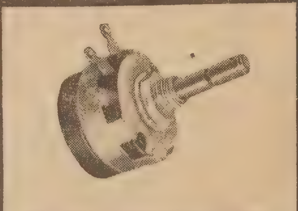
2 **IRC TYPE EC TAB-MOUNTED TRIMMER OR PRESET CONTROL.** A new low cost control designed for circuits requiring only occasional adjustment by factory or service personnel. The control is adjustable with any instrument having a screwdriver tip and is accessible front or rear of control.

3 **IRC TYPE Z VOLUME CONTROL** is the tropicalised form of carbon volume control, and is completely sealed in a metal housing. The spindle is fitted with a pressure gland to maintain the seal in operation.

4 **IRC TYPE ZW RHEOSTAT POTENTIOMETER** is similar to Z in appearance, only it is a sealed wire-wound potentiometer. The spindle also is fitted with a pressure gland to maintain the seal during operation. Ohms range standard values between 2 ohms and 10,000 ohms.

WRITE OR 'PHONE YOUR USUAL SUPPLIER FOR FULL DETAILS.

IRC Ganged Type Controls, in 2, 3 and 4 Gangs

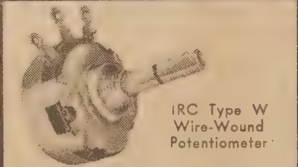


IRC Type CS Metallised Control

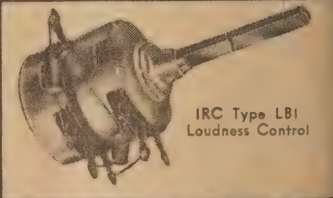
IRC Miniature Type Q Volume Control

IRC Type CS Concentric Dual Control

Ask your Supplier for full details



IRC Type W Wire-Wound Potentiometer



IRC Type LBI Loudness Control

Sole Australian Agents:

Wm. J. McLellan & Co. Pty. Ltd.

126 SUSSEX STREET, SYDNEY - BX1131

(50 yards from King St.)

BACKED BY OVER 20 YEARS'

AUSTRALIAN VOLUME CONTROL MANUFACTURING EXPERIENCE

brief but it serves to show how easily a serviceman can be caught out, even an old greybeard like yours truly.

It was just an ordinary old set, of the type which still "graces" many suburban homes—a five valve superhet with valve equipment of the 6A7, 6D6 variety. As received, it played stations all right, but in a very weak and distorted fashion.

I took one look at the 6B7S "detector" and guessed that the screen supply resistor was open circuited. In my book, there are few more unsatisfactory components than the high value resistor which feeds a pentode audio screen.

Accordingly, I turned the receiver over, checked the screen and found, as I had expected, no voltage whatever. A continuity check showed the capacitor to be in order, so it was simply a case of wiring in a new 1.5meg. resistor to replace the original one.

This done, the set played quite loudly again and I was almost ready to reach for the charge docket.

However, since I had spent next to no time on the chassis, I decided to give it a bit of a "birthday" and a general check for good measure. Accordingly, the valves were removed and cleaned one by one, the chassis wiped down as well as possible and the dust blown out of the capacitor plates.

A SPOT OF OIL

A spot of oil on the dial mechanism and pot. shafts improved their operation, the pointer was straightened and the dial glass cleaned. Lastly, a quick check over all wiring and components, a similar check of the alignment and the customer had his money's worth.

But wait, that old 10mfd. electro across the output valve cathode had probably not been replaced since the set was built even though it looked respectable enough. It probably didn't have much capacitance left and it might be affecting gain and tonal balance. Better put in a new one, even though it was a bit hard to get at.

This done, the set sounded suspiciously distorted and a check showed something like 30 volts of bias on the output valve. A further check revealed the reason—the cathode bias resistor was open circuited.

Tracing back, I found that the old electro had conditioned itself somehow to passing about the right cathode current and developing about the right bias. It had neither open circuited nor short-circuited, as one might have expected in the circumstances.

The new, replacement electro wasn't so accommodating and immediately revealed the faulty resistor.

But how easy I could have been caught. The set could have been returned quite innocently with an O/C bias resistor, to play for months in that condition—or to fail almost immediately.

A NEAR THING

It's disturbing to realise that one's reputation as a serviceman can hang on so fine a thread but it's also reassuring to know that the Gremlins are sometimes on your side.

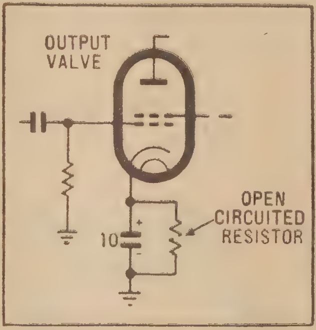
A TV job which I ran across during the month was simple but well worth a mention, because it sets the pattern for many similar complaints from now on, as valves begin to age.

There I go again, giving the show away before I've begun the story.

The set was of well-known make and the complaint was to the effect that the picture tended to shrink in height after a few minutes of operation. When switched off, it would apparently recover so that the picture was normal at next use—but it would inevitably begin to shrink shortly afterwards.

When I arrived on the scene, the set duly misbehaved in the manner described—or nearly so. In point of fact, there was evidence of the picture shrinking almost immediately from switch-on but it didn't become obvious to the casual viewer until the limits of the scan had crept from behind the mask.

It seemed fairly clearly to be a fault in the frame circuitry because any general trouble as, for example, reducing H.T. voltage would have affected the picture width and brightness to some degree at least. As it was, the picture seemed to get brighter as the scanned area decreased.



A leaking coupling capacitor in an amplifier control unit put a slight positive voltage across the volume control pot, causing a "plop" when the control was swung through its travel.

The trouble could have been due to a resistor or electrolytic somewhere in the frame circuit but I was inclined to think not. Their pattern of failure is scarcely as regular as this one appeared to be, besides which faulty electros often emit a quite tell-tale odour.

My pick was a valve, probably the frame output valve. This has to work fairly hard in the average TV set and a failing cathode with possible gas leakage could explain the trouble.

Apparently I picked it in one, because a new 6AQ5 restored law and order, the picture no longer attempting to take on the proportions of Cinemascope in miniature.

NO PICTURE!

The present activity in television has resurrected an old cry, to judge by two or three tales of woe which have been related to me during the past month.

The most eloquent was from an acquaintance who installed a TV set just before last Christmas. He kept it through the trial period, was apparently satisfied, despite a couple of minor faults, and duly paid for it in spot cash.

No sooner had the amount been deducted from his credit balance by the banking eagles, than the set blacked out completely. It was picked up, repaired under guarantee and returned.

It played for another week, then b gan to emit smoke from the little hol in the back cover. Another complain another service call.

So the tale continued, ending with th information that the picture was no horribly "tall and skinny" and the peop who had originally sold him the s didn't seem to be in too much of hurry now to fix it.

"It's the old story," he complained "Pay cash for a thing and you can't ge any service."

Having had this said to me at leas twice in the one week, I'm beginning t wonder how many other people hav similar feelings. Or how many fellow servicemen have the same idea throw at them.

The customer reasons that, if he pay cash for a receiver, the retailer has hi money and can thereafter offer as many excuses as he likes for withholding o delaying service. On the other hand, i time payment is involved in one form or another, the customer can simply stop payments until satisfaction is given

He reasons that, since he has the se and the outstanding money, he holds the whip hand.

PAID ANYWAY

In actual fact the position is anything but that. Most retailers don't handle their own terms at all but simply act as agents for a separate finance company. They make the sale and complete the necessary papers. They accept the deposit and later accept the instalments.

In the meantime, however, the retailer has been paid his price in cash by the finance company, so that the set is paid for anyway, as far as he is concerned.

If the purchaser tries to bring pressure to bear by witholding payments, the most likely result will be a letter from the Finance Company, signed by a gentleman who is far more interested in books of account than the technicalities of a client's television receiver.

In the ensuing exchange of letters some question may be asked of the Retailer as to what this is all about but any pressure on him which results, is only of a very secondary order. After all, he has sold the set and been paid for it and is bound only by whatever service undertakings he gave at the time of sale.

He will be generous or otherwise in the matter of after-sales service, according to the type of person he is and the way he runs his business.

The real fact of the matter is that Retailers who want to stay in business meet all their obligations—and sometimes more—primarily to build and keep goodwill. The routine by which they receive payment for the set is incidental.

GOOD AND BAD

But I'm not so naive as to assume that everyone in the television selling business is quite so concerned about long-term goodwill. There are doubtless those who cannot or will not give more than a minimum of technical service.

If the case arises where a set is obviously faulty and the Retailer is obviously avoiding his responsibilities, the best party to contact is the receiver manufacturer. He knows only too well that a dissatisfied owner can lose him a lot of sales and he is likely to be

(Continued on Page 63)

I'm a perfectionist!

I'M ALWAYS SURE OF JOINTS SOLDERED WITH . . .

ERSIN Multicore 5 CORE SOLDER

PACKED IN A CONVENIENT DISPENSER PACK

I know Multicore. I know leading radio and television manufacturers in most countries of the world, including U.S.A. use it exclusively. For Multicore is the only solder with more than one core of flux built right in to the solder itself Multicore has five!

This is complete protection against dry joints . . and as Multicore uses only virgin metals, every inch is top quality.

I like the dispenser pack — the wire draws from the top without twisting or damage.

I like the fact that you use far less Multicore on every joint. Top quality convenient, economical and now made right here in a modern Australian plant. What more could you want?

HOW TO USE MULTICORE—apply Ersin Multicore Solder simultaneously with the iron or other means of heat to the clean components to be-soldered. No additional flux is required. Only apply solder direct to the iron for tinning. Do not carry solder to the joint on the iron.

PULL AS REQUIRED
SIZE
DIAM
16 S.W.G.
LB. NETT WT
CONTAINS 5 CORES
ERSIN
Multicore
FIVE CORE SOLDER
CONTAINS 5 CORES OF NON-CORROSIVE FLUX
HIGH TIN TELEVISION & RADIO QUALITY
60/40
MADE IN AUSTRALIA

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AVAILABLE FROM ALL LEADING ELECTRICAL WHOLESALERS AND HARDWARE AND RADIO SERVICE STORES

LET'S LOOK AT GUIDED MISSILES

(Continued from page 19)

tained until mid-course guidance takes over.

For long range missiles, mid-course guidance often takes the form of a built-in navigational system.

This is an electronic computer into which all the information required by the missile is recorded prior to launching.

Connected to this device is a system of accelerometers. One form of this instrument is a condenser type of pick-up. It has a suspended mass which has only one degree of freedom. This mass actuates a diaphragm which is part of the condenser and the variation in the capacity caused through movement or acceleration will measure the acceleration of the missile.

Another type is merely a mass supported by a spring. The movement of this mass actuates the arm of a potentiometer which registers the variation of current as a measure of the acceleration.

ACCELEROMETERS

Several types of accelerometers may be installed in the missile which together register the acceleration in every direction. Thus if the accelerometers give information to the internal computer which is different from that to which the latter was set the computer will automatically make the necessary correction. Error signals are transmitted from it to the servo mechanisms which will then make the necessary changes in power thrust, angle or control devices.

With atomic war heads it is, of course, not necessary that the missile should hit the target directly because the effects of an atomic explosion are widely dispersed.

Thus the final stage of "terminal guidance" need not be as accurate as might be imagined. It is only necessary that the missile reach within a few miles of the target.

"Terminal guidance" or homing has only a very short range and may be brought about by infra-red rays from the target actuating the devices in the missile.

ACTIVE HOMING

The ultimate in terminal guidance is "active homing" where the missile emits its own radar impulses which search out a target and direct the missile to it.

A missile which is being tested is fitted with apparatus called telemeters which are electronic devices. These collect the data to be measured and convert it so that it can be superimposed on a radio carrier, after another instrument encodes it for transmission.

These encoded signals are then transmitted to the control station on the ground. Here it is recorded on either a low speed record where any channel can be recorded separately or on a high speed record which can give all the information transmitted by the missile, by subsequent analysis.

Information is analysed by electronic computers. These computers are so fast that one type can give the sum of the squares of all numbers from 1 to 10,000 in 60 seconds.

The information is fed into the computer on high speed tape on which the information is impressed as punched holes. As the tape passes through the machine light passes through the holes and actuates photoelectric cells which in turn pass on the coded information to the valves of the computer.

Storage banks in the computer consist of either drums of magnetic tape or spots of light on cathode ray tubes. Then there are magnetic drums which store countless items of information on the magnetic surface.

These drums are continually revolving and information can be taken off at any required time.

The processed information is then automatically printed by high speed printing machines which can print 600 lines each of 130 characters per minute.

BRITISH COMPUTER

One of the largest computers in the world is at Farnborough, England. It occupies 6,000 square feet of floor space and has 8,000 radio valves in its circuits.

This particular instrument can simulate the entire operation of a missile.

Even parts of missiles can be connected into the machine and tested in such a way as if they were parts of the actual missile itself. With its aid it is possible to test missiles without firing them, thus saving a tremendous amount of time and money and human effort.

This short discussion will, it is hoped, help the uninitiated to more fully understand the tremendous effort which goes into the testing and manufacture of a guided missile. Information of the subject is necessarily limited because of the secrecy which surrounds the projects. No doubt by the time this is printed more advanced techniques will have been developed, so fast does science advance.

THE SERVICEMAN WHO TELLS

(Continued from page 61)

most interested in any Retailer who is doing a disservice by selling his product.

And, of course, if the receiver is really "jinxed," there is no one in a better position to produce cosmos out of chaos than the manufacturer's own service department.

Don't be alarmed if, in saying this, I seem to be talking independent servicemen out of a job. Most of them are pretty canny, anyway, about buying into arguments between owner, Retailer and Finance Company.

Oh yes, back to technical matters for a moment.

Ladies, you do not re-set a dial pointer by winding it hard against the end of its travel. The idea works occasionally but, as often as not, you just succeed in bending the pointer or breaking the dial cord.

My most tedious job of the month was a dial cord which had to be replaced for just this reason.

The worst part of it is that the lady who was sufficiently "technical" to work out the process, was also sufficiently technical to know what had happened. And you try to convince a lady that she owes you a regular service fee for just replacing a piece of string.

The RADIOMASTER

RADIOGRAN

CHASSIS . . .

A great performer o
Radio and Records

HI-FI MODEL E22 reproduces perfe high treble notes and bass not without "drumming" or distortion brings recorded sound to your hon as near as possible to the original. high gain R.F. stage ensures sati factory long distance radio receptio regardless of location. Features i clude:—

- *Treble and bass boost with separa controls.*
- *Two matched Jensen speakers (12i and 6in) with crossover network*
- *Eight valves, world range.*
- *Push-pull output—inverse feedback*
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- *Latest type Radiotron valves.*
- *Custom built — six months' guarantee.*
- *Frequency coverage: 40 to 13,50 cycles.*
- *Design tested and approved by th Valve Application Division o Amalgamated Wireless (A'sia) Ltd*

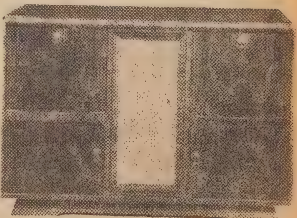
PRICE **£41/15/**

Magic Eye tuning indicator 30/- extra. Packing included. Freight extra.

Other Radiomaster Radiogram chassis are available from **£23/5/**
Write for particulars.

Television chassis from **£121**

RADIOGRAM CABINETS



Many popular designs available including contemporary in natural maple.

NEW CABINET MODELS FOR HI-FI CHASSIS incorporates vented speaker enclosures which provide for dual speakers in separate compartments with "woofer" compartment felt lined and draped. First-class finish.

ALL TYPES OF THREE-SPEED RADIOGRAM UNITS

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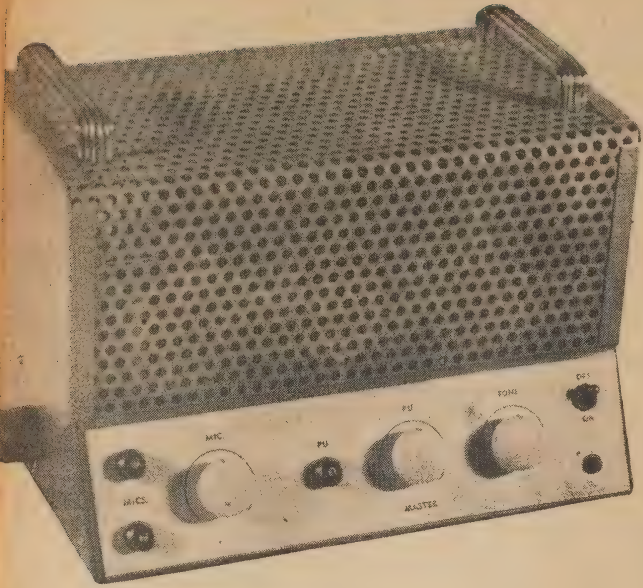


A view of the completed amplifier. Controls from left to right are, two microphone input sockets, the microphone channel volume control, the pickup input socket, the combined pickup volume control and master control for the mixer unit, the tone control, and the on-off switch and indicator bezel.

A 35-Watt Amplifier With Control Unit

☆

PART TWO

☆

Here is part two of our article on a 35-watt public address amplifier. It describes construction of the amplifier on a new, smaller chassis, then introduces a completely new preamplifier-mixer unit for use where multiple input channels are required.

by Wes Yashin

As described last month, the basic amplifier is adequate for most P.A. needs, having a twin microphone and one pickup channel, mixing facilities, a treble-cut tone control and ample power output.

FUNCTION OF UNIT

The new preamplifier-mixer unit is intended to supplement these basic input facilities for stage or other specialised work, requiring several microphone and pickup input channels. While intended primarily for our 35-Watt P.A. Amplifier, the mixer unit can obviously be used with other existing amplifiers, to increase their usefulness. It will be described fully in the latter portion of the article.

The developmental work on the circuit of our basic amplifier left us little time to consider an ideal physical layout and we were more or less forced to compromise by showing it built up on the previously available 40-watt amplifier chassis.

However, as we intimated in the article, we have since had opportunity to review the position. The result is the same amplifier, built on a chassis of smaller dimensions but having an almost identical component layout. Only the rectifier and the associated wiring has been shifted.

The new chassis was hand-made from 16-gauge aluminium, measuring 13¼ x 7½ inches across the top and 13¼ x 9 inches across the bottom, the difference being due to the sloping front.

The original depth of 3 inches was maintained.

While readers could likewise make up their own chassis, a blueprint will be released and a ready-punched steel chassis should therefore become available through trade houses in the normal way.

We went a step further and had a chassis manufacturer make up a perforated metal cover. As the photograph shows, the result is a very neat and attractive piece of equipment.

METAL WORK

The sides of the cover are of sheet metal and overlap the chassis sides by a half inch or so. Nuts and bolts through the overlapping portions hold the cover in place. A pair of handles on the top of the cover facilitate handling and add to the appearance.

The addition of a label to the front panel will also enhance the appearance and facilitate use of the controls. Our original label was made from white card with Indian ink lettering and protected by celluloid sheet. Should the demand prove sufficient, at least one manufacturer plans to make an etched label available.

A glance at the front view of the chassis will reveal that the layout is essentially the same as that of the original, the difference being in the closer grouping of the components, a more forward position for the rectifier socket and the addition of the "on-off" switch and indicator bezel on the front panel.

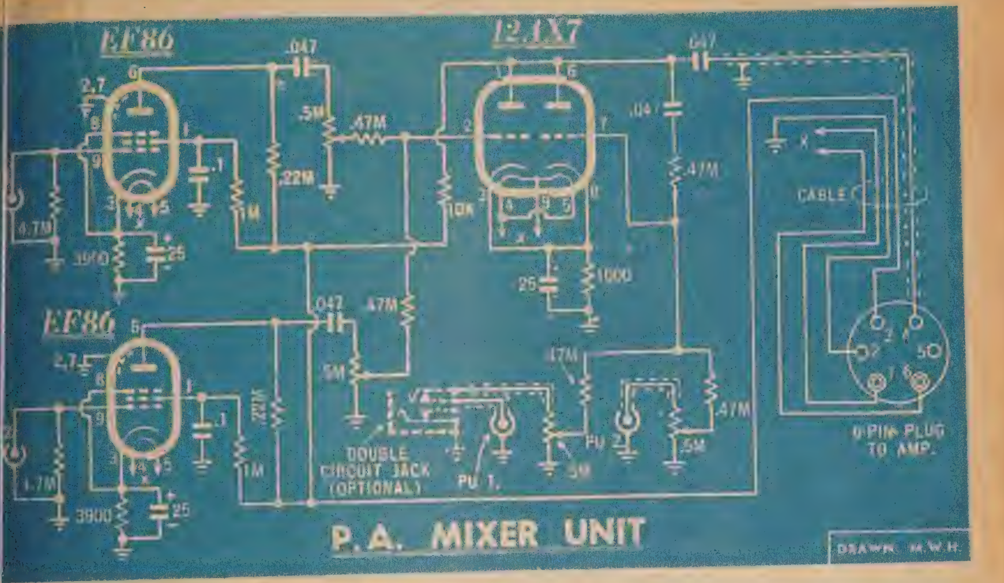
Some of the under-chassis wiring has been altered to suit the altered grouping, but the rest of it remains unaltered. In fact, in rebuilding the amplifier we were able to transfer whole sections of the wiring onto the new chassis.

EARTH POINTS

As with the original amplifier, certain precautions should be observed when wiring. A common earth point for each of the voltage amplifier stages is essential, if hum due to earth loops is to be avoided. The input connectors must be insulated from the chassis and connected to their respective common earth points near the relevant valve sockets.

It is a wise precaution to connect the remaining earth points together with a common run of heavy tinned copper wire, to guard against poor contact with

CIRCUIT DIAGRAM OF THE PRE-AMPLIFIER UNIT



T circuit of a suggested mixer unit. Note that feedback is used to control the gain of the pickup section of the mixer valve.

e chassis in the future, due to rust r orrosion.

further critical piece of wiring in-es the two .47 meg isolating resistors e grid circuit of the second stage. e must be mounted as close to the i pin as possible, with no more than it half an inch of attaching lead. lugs of an eight-lug mounting strip used to support their free ends while h common end is anchored directly at h grid pin of the valve socket.

he method of terminating the output sformer secondary leads is also thy of mention. In the new version, h secondary leads are terminated at a n-lug bakelite strip equipped with w terminals. This arrangement is l for temporary installations. An l socket is wired in parallel with h bakelite strip and provides an alter-ve means for connecting to the speak-system.

PUT REQUIREMENTS

lthough the amplifier is quite versa-i as it stands and is likely to cover st situations met with in public ress work, we felt that a separate er unit with a number of extra chan-s was warranted. We have certainly d numerous requests for such a unit.

After some consideration the present ign was evolved. It consists of two rophone and two pickup channels ding into the grids of a twin triode xer. The mixer output is then fed into pickup channel on the main ampli-r, the gain control of this stage be-ming the master gain control.

The net result is that three micro-one channels and two pickup channels now available with mixing facilities r each.

The number of mic. and pickup channels in the mixer unit need not be limited to two as a slightly longer chassis than specified could quite easily accommodate three of each. Alternative schemes to suit unusual situations may be quite readily introducd.

A possible modification may consist of an amplifier valve in each pickup channel designed for low level pickups and with suitable compensation for recording characteristics. A suggested circuit is reproduced and consists of a high gain pentode, with a compensating network in the plate circuit. The constants chosen are for the R.I.A.A. curve, which has now become standard with practically all recording companies.

Also included by way of interest is a double circuit jack, connected into one pickup channel. It was not physically wired into the mixer unit and can be treated as entirely optional. However, telephone jacks, wired as shown into one or more channels, provide an extra input facility and also allows rapid interchange from one programme source to another.

Referring to the circuit, you will note that mixing of each pair of channels is accomplished by simple resistance networks feeding the respective grids of a twin triode. The output from all four channels finally come together in a common plate load.

The gain of the pickup section of the mixer valve is deliberately kept low by the use of a small plate load and, plate-to-grid feedback through an isolating capacitor and a .47 meg resistor. Feedback around this stage does more than reduce the gain; it also reduces distortion by an appropriate amount and any residual treble loss due to smaller effect.

PARTS LIST

For parts lists of amplifier see March issue.

1 Chassis with sloping front panel (10in x 3½in top, 10in x 4½in bottom.)
1 Top cover to suit above.
1 Bottom cover to suit above.
2 Noval sockets with shields.
1 Noval socket.
1 6-pin plug with cover.
4 Single contact microphone connectors.

VALVES.
2 EF86, 1 12AX7.

CAPACITORS.
3 25 mfd 40 volt electrolytics.
2 .1 mfd 400 volt paper.
4 .047 mfd 400 volt paper.

RESISTORS
2 4.7 meg ½ watt.
2 1 meg ½ watt.
5 .47 meg ½ watt.
2 .22 meg ½ watt.
1 .01 meg ½ watt.
2 3900 ohm ½ watt.
1 1000 ohm ½ watt.
4 .5 meg potentiometers.

SUNDRIES
1 8-lug strip, 1 6-lug strip, 1 3-lug strip, 2 2-lug strips, hookup wire tinned copper wire, coaxial cable, spaghetti, nuts and bolts, solder lugs, knobs.

NEW FERGUSON FILTER CHOKES

FERGUSON announce the release of a new series of small economical filter chokes for use in radio and T.V. sets, amplifiers, etc.

These new chokes are fitted with robust cadmium plated steel wrap-over brackets firr ly crimped to the core. They are thoroughl impregnated, and fitted with solidly anchore connection leads.

Type Number	Ind. Henries	Current D.C.M.A.	D.C.Resis. Ohms	Dimensions—inches				Appro Weigh
				Height	Width	Length	Mounting Centres	
F14-60	14	60	550	1-¾	1-¾	2-⅛	2-½	14 oz.
F6-100	6	100	210	1-¾	1-¾	2-⅛	2-½	14 oz
F12-100	12	100	265	2-¼	2-¼	2-¾	3-⅛	2 lb.
F1-285	1	285	48	1-¾	1-¾	2-⅛	2-½	14 oz.
F1-325	1	325	27	2-¼	2-¼	2-¾	3-⅛	2 lb.

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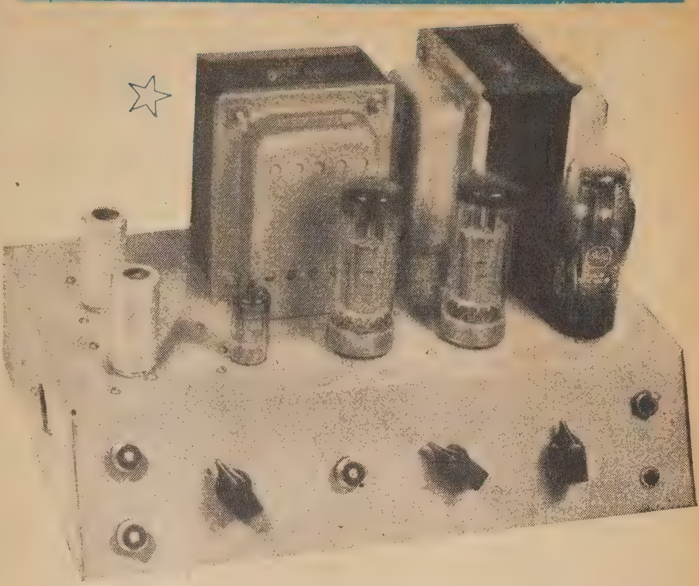


The amplifier with cover removed. A considerable saving in space was achieved by the closer grouping of components. The GZ34 is at the extreme right, the EL34s top centre, the 12AX7 and the EF86 to the left. The microphone preamplifier directly behind the first EF86.

actual gain of this stage is a little wo times to offset the two-to-one troduced by the mixing circuit in d. The input sensitivity of the channel on the mixer unit thus s equal to that of the pickup l on the main amplifier, being ing over 100 millivolts for full

ough we did not draw up a set uency response curves for the unit, ecked to see that the response flat to at least 10Kc and re adequate for PA work. The response of the amplifier, too, e good, being level to well beyond depending on the secondary tap

effort has been made to reduce n of the microphone section of the valve, as this extra gain in the hannel is of no consequence.

MPLIFIERS

mic. preamplifier stages use EF86 29) pentodes, whose low noise and onstruction show to good advantage this application. Under normal ing conditions the noise is quite nd microphony problems of no uence, allowing the use of stan- ocket mountings.

mon earth points are not essential mixer unit since there are no equency chassis currents to cause hrough earth loops. However, if a hassis is used, the precaution of all the earth points with a run vy tinned copper wire is advisable.

HT supply to the mixer unit is from the main amplifier through n plug and socket arrangement. high tension points are available 6-pin socket on the amplifier, one ts directly to the main HT line. the other is taken from the de d point feeding the microphone plifier tag. This latter point was sed to supply the HT to the mixer coupling being quite adequate.

extra drain of the mixer unit the HT at this point and consequently the gain of the stages feeding from this point. However, the decrease in gain is not substantial and in practice would not be missed, since there is plenty to spare.

At no time did we experience instability even with all the gain controls turned full on. Operated in this manner the noise level is naturally fairly high, but this is a completely unrealistic situation, since the unit is not likely to be operated with more than two gain controls turned partly on at any one time.

The input sensitivity of the mic. channel is very high requiring less than one millivolt input for full output. In practice it is possible to obtain satisfactory operation from a low impedance microphone, even without an input transformer. Although this again is an unlikely situation, it gives a good idea of the overall performance.

We constructed the mixer unit on a chassis measuring 10in x 3½in across the top and 10in x 4½in across the bottom, due to the sloping front to match that of the main amplifier. A perforated metal cover was also made to match.

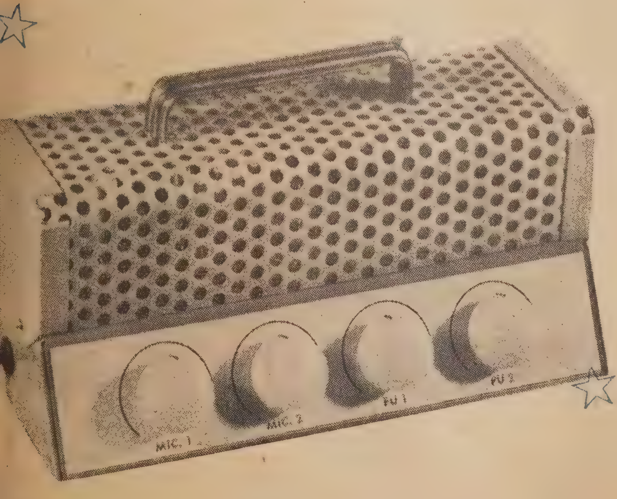
LAYOUT

A suggested valve layout is to place the preamplifier stages along the rear of the chassis while the mixer valve may be placed forward in the centre of the chassis. The controls may be grouped and spaced to suit the number of stages used. The input connectors are placed along the rear edge of the chassis, resulting in very short leads to the grids of the mic. preamplifiers.

Liberal use is made of tag strips in mounting the various minor components, although a number of these are suspended by their pigtails.

Looking over the rear edge of the chassis, the 8-tag terminal strip, parallel to the left edge of the chassis, supports the outgoing power supply and output leads. It also provides anchor points for the screen dropping resistor and bypass of the nearer mic. stage and the bias resistor and bypass of the same stage.

A 6-lug strip directly in front of the



mixer unit matches the main amplifier. Knobs left to right are, two microphone volume controls and two pickup volume controls.

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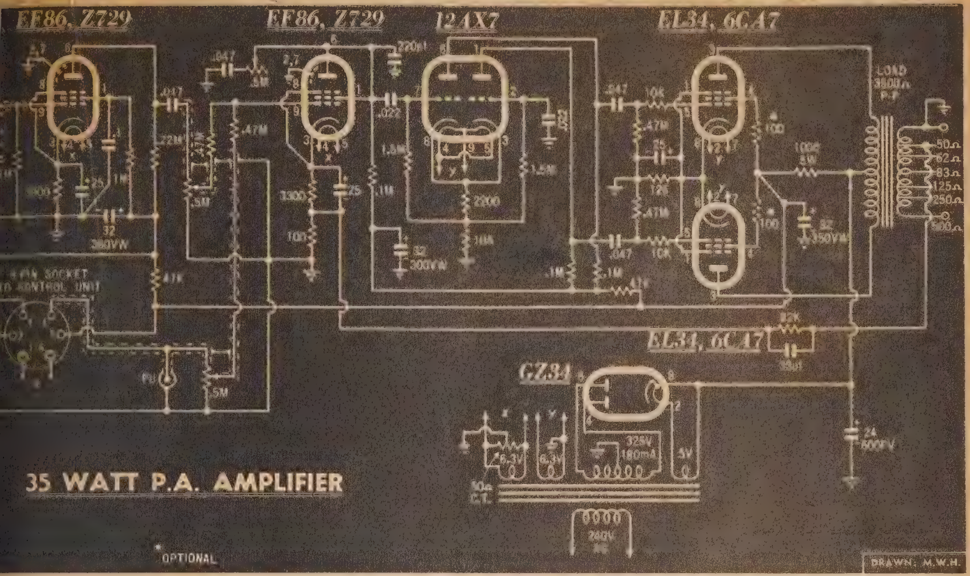


amplifier circuit is quite straight-forward and identical with that published last month. Should it be necessary to control the tension due to the use of a different power transformer, a GZ32 or 5V4 rectifier may be substituted. Alternatively a wire wound resistor wired between the centre tap and chassis will also reduce the voltage to the required figure.

l mic. stage supports the plate and resistors for that stage as well plate load for the adjoining microstage and the mixer stage. The ng capacitors to the volume controls are suspended between points on rip and the appropriate lugs on the e controls.

wo-lug strip directly in front of lug strip and at right angles to ont edge of the chassis supports olating resistors for the two mic. and the connecting lead to th f the mixer valve.

coupling capacitor to the mixer and the outgoing output lead are red at another two-lug strip, which wen the second and the third iometers and is held by one of the valve socket mounting bolts.

NG CIRCUIT

3-lug strip to the right of this ts the isolating resistors in the mixing section, as well as the ack components around that sec f the mixer.

additional stages could follow the order of component layout which extremely critical provided the precautions pertaining to grid and eads are adhered to.

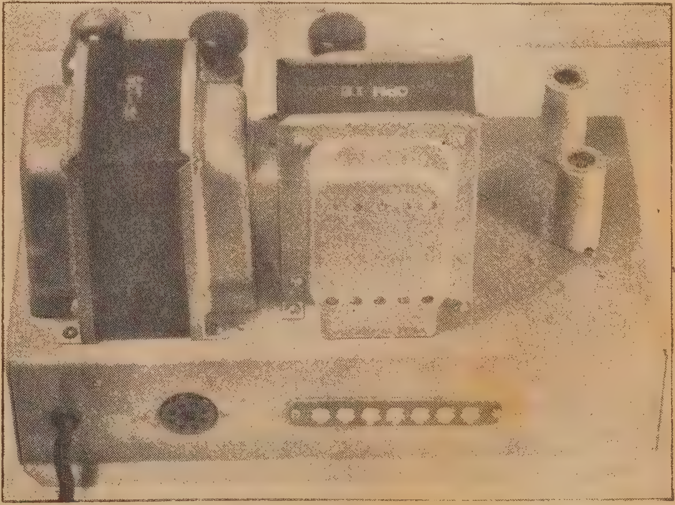
lly, a few words about the various of PA microphones may be of

stal microphones are probably the opular types in use to-day, mainly e of their low cost. (Some of the inserts are available for less 2.) This, coupled with fair average mance and reasonably high output them an attractive proposition

the same time these units have imitations, and an appeciation of may help the reader to make a better choice when he considers his own particular requirements.

The very cheapest inserts have a marked peak in the response around the "speech region"; a characteristic which can be quite useful in some communications systems, but which can seriously aggravate the feedback problem in PA systems. Better quality inserts, costing a little more, have much smoother response curves and are definitely to be preferred. In fact, the best crystal units are capable of excellent PA performance.

Crystal devices are, by their very nature, fragile in some respects, and need to be treated with a certain amount



This rear view of the amplifier chassis shows the terminal strip on the rear edge, a useful feature for temporary installations. For a permanent installation the octal socket would be used. The power and output transformer placement is clearly indicated. The power transformer is to the left while the output transformer is to the right.

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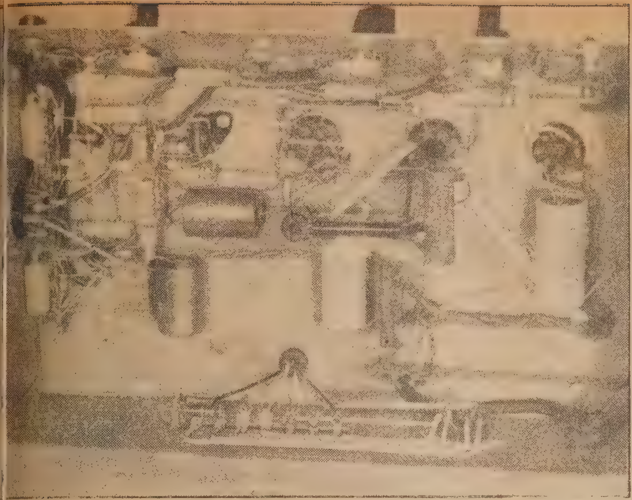


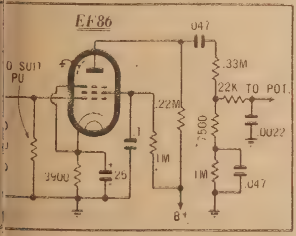
picture gives an excellent idea of the wiring and minor component layout

commonsense. Their two greatest nies are humidity and heat. The ers can guard against most humidity blems by careful sealing techniques, precautions against heat are up to user

GH TEMPERATURE

t temperatures around 120F and er a crystal can be completely des- ed, no matter how well it is sealed. peratures of this order are easily luced inside a microphone case left right sunlight for any length of time, ing this type unsuitable, in general exposed daytime outdoor work.

rystal microphones have a high im- ance output, meaning that losses can quite severe if long lengths of shield cable have to be used. However, due the high capacitance of the crystal it- e, these losses are essentially constant all frequencies, so that the problem is nly one of providing sufficient reserve gain in the amplifier to take care of . Usually, this is not a difficult uirement to satisfy, for lengths of le up to, say, 30 ft



suggested circuit for a low level ckup input channel. Compensation is for an RIAA characteristic

robably next in popularity is the amic type, again due to the fact that r cost is reasonable, though usually ater than the crystal types. Some of cheaper types suffer from peaky ponse in much the same manner as equivalent crystal types, and are thus ally undesirable.

However, assuming a smooth response, this type has much to recommend it. It is robust, being ruggedly constructed and immune to heat and other weather conditions, and therefore well suited for outdoor use.

Its natural output impedance (the "voice call" impedance) is generally 50 ohms. This is a useful figure and a line operating at this impedance may be almost any length without introducing serious losses, and need not be shielded. In fact almost any form of twin cable may be employed, such as twin lighting flex etc.

It may even be possible to couple the microphone directly into the amplifier at this impedance if the gain of the latter is high enough, but it is more usual to provide a transformer close to the main amplifier to convert to a high impedancer. This transformer will be quite prone to hum pickup from the power transformer and will need to be mounted several feet from it, or employ expensive mu-metal shields.

RIBBON TYPE

Two types are normally available. One is the true "velocity" type, having the ribbon open to sound on both sides, and the other a modified version, with one side of the ribbon closed off.

The velocity type has a "figure 8" pattern, being equally sensitive back and front, but quite insensitive on each side. This feature is sometimes useful in controlling feedback if the speakers can be located in the "dead" regions.

Due to the "velocity" characteristic, the bass response tends to rise if the source of sound is closer than about two feet. This may be a serious restriction in PA work if the bass boost cannot be tolerated.

The other type has no appreciable pickup from the rear and, because it is no longer a "velocity" type, has no bass boost problem and can be used for close talking. In fact, the response favours the high note region, making the repoduction rather high pitched and tending to aggravate the feedback problem, in spite of its more resticted pickup pattern.

THE TENNA-TIE

Here is a small unit which can improve TV reception for many viewers.

Many TV sets around Sydney are connected to an outside aerial which often gives too much signal and can actually overload your set and spoil the picture. However, this high-gain type of aerial is often necessary to eliminate ghosts and other forms of interference which a simple aerial cannot do.

If you find that Channel 2, for example, has a type of herringbone pattern or wiggly lines through the picture, or if you cannot reduce the amount of black sufficiently with the contrast control, this is a sure sign of too much signal. If, when watching Channel 7 or Channel 9 you can see a dark vertical band waving across the screen from left to right you are getting too much signal and Channel 7 is spreading into Channel 9 and/or vice versa.

Now this Channel Master Tenna-Tie is the efficient remedy for such troubles. It is correctly designed to control the signal to the required strength from all three TV stations and to give you a perfect picture. It will work on any aerial and any make of TV receiver. So don't be concerned if you are getting too much signal. It is in fact a "good fault" easily cured by this Channel Master Tenna-Tie.

The cost is only 37/6. Very clear fitting instructions are packed with each unit which can be conected at the back of your set in a few moments. Your retailer will be very pleased to advise you or ring **Channel Master XF0221, 752 Pittwater Road, Brookvale or B1516, 446 King Street, Newcastle or Channel Master, FJ6634, 576 Elizabeth Street, Melbourne.**

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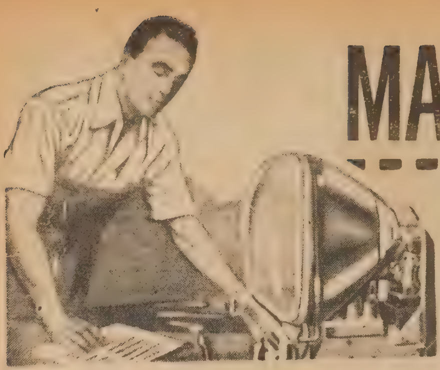

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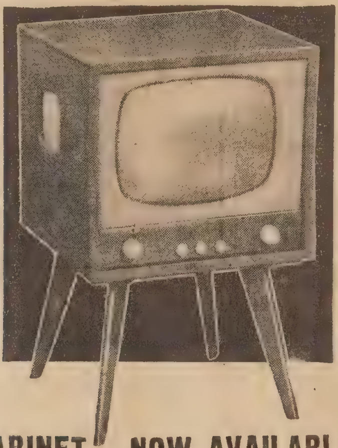

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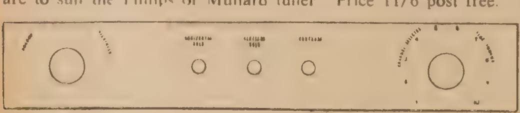

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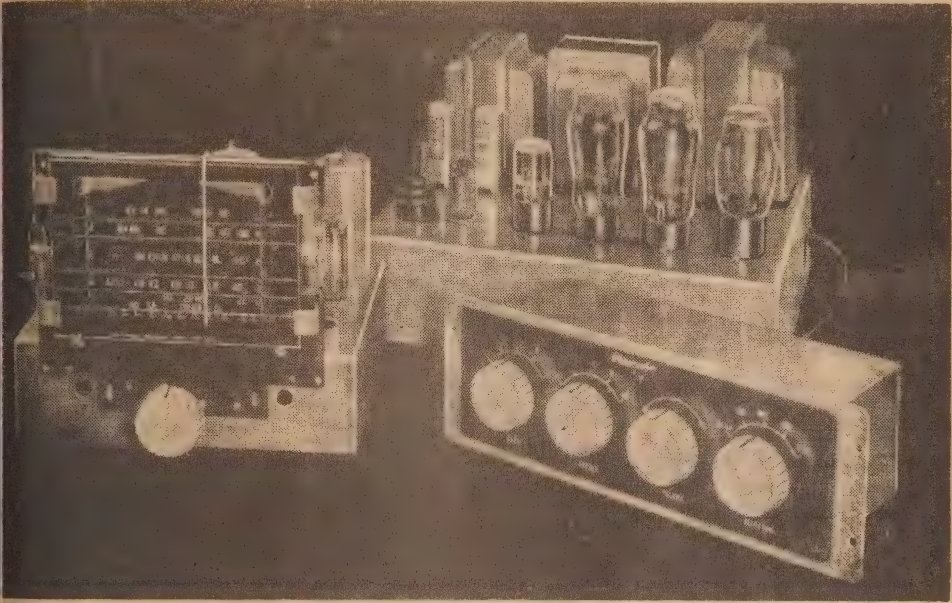

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Here's your answer, Tom!

This month Tom seems to have fired a bundle of television receiver problems at us. Perhaps hi amplifier is finished and his new interest is Mum's television receiver. Look out, Mum!

Since the recent heavy rain my TV receiver has been completely free from a "two banded" snow-like interference which tended to roll up or down the screen. Can you offer a possible explanation for this?

We make a point of offering an explanation for anything Tom. Whether it is the right one is another matter. Seriously though, we think we can explain this rather puzzling interference, particularly as two members of our staff have experienced the same effect and have both arrived at the same conclusion independently.

The vital clue was the "cure" brought about by the rain. Anyone who has ever had to suffer radio reception in outlying areas will be familiar with a similar effect. During dry spells electrical interference from H.T. power lines can be quite severe, blotting out all but the most powerful local signals.

The trouble appears to be due to leakage across the insulators, caused in turn by layers of dust which settle on them. When such a leakage path is multiplied by the several hundred insulators in a few miles of power line, it is easy to appreciate how it can create such a racket.

NATURAL CLEANING

Yet, within a couple of minutes of a downpour of rain, the hissing and frying will vanish as though turned off at a master switch. Nature has done what man could not hope to attempt—washed each insulator clean and free from the noise producing dust.

This condition may last from a few hours to several weeks, depending on the weather conditions, but sooner or later there will be heard a few tentative splutters; a crackle or two—and within a few hours the whole broadcast band will be cluttered up again.

I understand a lot of research has been devoted to the problem, mainly in trying to develop an insulator which would minimise the effect of dust deposits, but with little success. Now, it seems, we are to be faced with the same problem in our TV systems.

The two bands per picture, and the slow rolling of the pattern, both tie in with a 50 cps interference. A 50 cps supply will produce 100 voltage peaks per second (one positive, one negative) resulting in two interference bars per field. If the bars are quite narrow, as is usually the case, it suggests that the major leakage occurs only during the peak voltage period.

The rolling is simply due to the difference between the nominal 50 cps of the mains, and which may vary considerably, and the more accurate 50 cps frame frequency transmitted by the station.

Since it was only an explanation you required Tom, this could well be the end of our discussion. It was kind of you not to mention the word "cure" because that's another story.

Off-hand, we could suggests moving to another district, persuading the supply authorities to move their power line, or even chopping down the HT poles.

More seriously, it may be possible to improve results in some cases by the use of better aerial set-up. Where the interference is behind or to one side of the aerial, the use of a highly directive aerial may help.

If the power line is between you and the station, you may be really "up against it." The only chance of relief would seem to be in finding a higher, or in some other way better, position for the aerial, where it would get more TV signal, if not less actual noise pickup.

"Albert! The line hold's gone!"

A friend informed me that when I switch my television receiver off I should wait approximately thirty seconds before switching on again. He said that the fuses would blow if I switched on again immediately. Is this correct?

Generally speaking Tom, it isn't essential to wait 30 seconds before switching your television receiver on again, but it may be desirable. If you do not, it is possible that you may blow the receiver's fuse or fuses as the case may be.

When switching a receiver on from cold the rectifier valve heats up and supplies H.T. to the electrolytic capacitors before the other valves in the receiver are hot enough to draw current. Thus the current rises to its normal operating value without serious surges.

On the other hand if the receiver is switched off, the electrolytics (which are of large capacitance ranging from about 40 mfd. to 200 mfd. giving a tot about 580 mfd.) give up their ch to supply the still hot valves.

When the receiver is quickly swi on again the power supply has to the hot valves and supply the ch current for the electrolytics as well. could overload the fuse or fuses ar cause a breakdown.

The manufacturers try to over the possibility of this surge interf with the fuses, by using anti-surge fuses. These do not always handle surge, unfortunately, and so a b down may result. At this stage a point to mention is that the fuses rated fairly close to their operating rent in most manufactured receiv

Not so fast Tom. We can guess are thinking— "Why do the man turers rate their fuses so close to operating current?"

The manufacturers wish to protec rectifier valves and the power t former. If a stage is drawing more rent than it should, the fuse will rather than damage the rectifiers v are probably passing close to maximum rated current anyway.

This fuse protection was incorpo in early broadcast receivers but ca more trouble than it was worth was not carried on. It will be interesting to see if in another years television receivers follow the pattern.

★ ★ ★

Why is the volume level affect by the contrast control in my T receiver?

Unfortunately, Tom, we do not what type of set you are using, s cannot give an exact answer. How two possibilities occur to us, and of them may apply to your set.

The first, and most likely, is tha contrast control is in the form of control in the IF and RF sections. know of at least one commercial rec that employs such an arrangement control simply varying the bias ap to these stages, much as was do early broadcast receivers.

Since these stages handle the s and vision signals in composite for is obvious that any adjustment of contrast can also affect the sound particularly if the limiter stages in sound channel are not doing their effectively. Fortunately, the convent volume control is always available the final adjustment of sound leve

The other possibility is that the cuit uses a trick which we menti in conjunction with our own 17 21in TV receivers. This was to up the 5.5 Mc sound IF from the Mc trap circuit in the cathode of video amplifier.

dherents of the scheme claim that provides a worthwhile gain in the d system, while it certainly makes stment of the 5.5 Mc trap easy and ive. However, since the contrast rol varies the gain of the video lifier, it may also affect the sound , again depending on the limiters. unately, the degree of change is not t, and a touch of the volume control l that is needed to correct it.

* * *

In a TV set, what causes the cture to appear minutes after the und?

hat's easy, Tom. The set is obviously English model, steeped in the tradi- of "Much Binding in the Marsh," re the radio sets invariably took . . a very long time to warm up." o?

n well, let's try another approach. rst of all, might not that word utes" be just a slight exaggeration? nittedly, when one can hear the dia- e and not see the action it may y seem like minutes, but it is ably only about an extra half ute one has to wait. It must also be ted out that not all sets take this , some producing a picture within w seconds of the sound.

he major factor controlling this time e type of EHT rectifier valve used. use the cathode of this valve will t the EHT potential above chassis, s difficult to operate it from the nal filament line. Instead, it is opera- from a winding of one or two turns the EHT transformer, the energy g supplied by the line output stage 5,625 cps.

O STAGES

his means that a TV set comes into ation in two stages. First we switch n and apply heater voltage to all valves, except the EHT rectifier. e warm up in the normal way, g about 30 seconds, and the line ut stage comes into operation.

is only now that we commence to ly energy to the EHT rectifier. If is a directly heated type it will take a few more seconds to reach ating temperature and deliver EHT ge to the final anode.

owever, if it is an indirectly heated , it will take at least another 30 nds to warm up, or even a little e if the filament supply regulation is . We imagine the set you describe f this type.

eanwhile, you sit biting your nails dering whether the "goodies" are ing the "baddies" or vice-versa. No der it seems a long time.

* * *

Is a TV set dear to run?

epends whether you've paid your ce Tom. If you haven't you will ably find yourself involved with the be hauled up before the beak, and to part over many pounds before regain your liberty. In this case, a set would be very dear to run, ably dearer than going to the pic- s.

owever, if you are a law abiding en, you are more likely referring to amount of power a TV set con- es. If so, we can be rather more ific.

Whereas a radio set consumes something between 40 and 60 watts for average models, the TV set is rather greedy by comparison. It will take between 200 and 250 watts, meaning that it will operate between four and five hours for one kilowatt (unit) of power.

A kilowatt may cost you anything from 1½d to 6d, depending on your supply authority and customer rating. Taking 2d as an average figure, we can operate our TV set for about one half-penny per hour—which is still pretty cheap pictures.

* * *

I am quite puzzled by differing opinions on Bradley oscillators for FM demodulation. Some claim that this circuit is not capable of demodulating AM signals such as noise and static, while others claim that this is impossible. If the first opinion is correct, then why is this circuit not used more in FM receivers, as it would be ideal in reducing ignition interference, which is very bad at the higher frequencies.

We must admit that you've got us with this query, Tom, because we are not familiar with the name "Bradley Oscillators." We rather gather from your letter, however, that the circuit may be similar to the Foster Seeley discriminator.

Perhaps one of our readers may be able to offer some comment regarding the application and features of this circuit.

* * *

In your articles you sometimes refer to gain controls. Are these the same as volume controls?

In either case, Tom, the control mentioned varies the amplification or gain of the equipment in question but, in the case of a receiver, a variation in gain results in a variation in volume so that either description may be applied with equal justification.

Communications receivers often have several controls which directly affect the volume and, as it would be confusing to label them all volume controls, we usually distinguish them by, RF gain, IF gain, audio gain, etc.

There are also cases where it would be incorrect to talk about volume controls. As an example, a cathode ray oscilloscope does not make audio sounds so that it is only correct to talk about its vertical gain control or its horizontal gain control as the case may be.

* * *

How dangerous is the EHT voltage in a TV set? I have been told that this may be as high as 20,000 volts.

The final anode circuit of the picture tube, which requires this voltage, would pass a current in the region of 100 uA, or about .1 mA. Mainly in the interest of safety, but also for economic reasons, the EHT power supply is designed to deliver just this small amount of current and no more.

If we attempt to draw appreciably more current than this we find that the voltage available immediately drops to a much lower value. Since it requires much more than this — several mA at least — before a shock becomes even mildly dangerous, such a power supply will do no more than deliver a nasty "bite."

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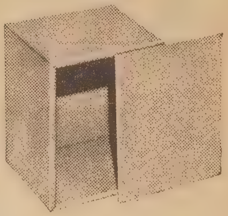

Standard Instrument Cases. Finish Grey.

Cat. No.	Long	High	Deep	Price plus 12½% S.T		
MC6	6	6	6		11	9
MC5	9	6	5		12	10
MC7	10	8	7		17	10
MC67	12	7	6		19	9
MC81	10	10	8	1	3	6
MC811	12	11	8	1	8	3
MC82	13	8	6¼	1	8	3
MC79	15	9	7	1	11	0

SLOPING FRONT CASES

SF7	7¼	6½	6		15	3
SF79	9¼	6½	7¼		19	6
SF71	11	6½	7¼	1	2	0
SF8	13	8	8½	1	6	6
SF10	18	10	10	2	1	0

R. & H. type Cabinets. finish Grey Hammerdock. louvred sides. welded corners.

Plus tax 12½%

MC5A	9	6⅝	5½		18	9
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MC87A	15	10	8	2	2	0

Sloping Front. R. & H. type, Grey Hammerdock finish.

SF7A	7½	7¼	7¼	1	1	0
SF79A	9¼	7¼	7¼	1	4	6
SF71A	11	7¼	7¼	1	9	6
SF8A	13	8¾	8¾	1	11	6
SF10H	18	10	10	2	6	0

Chassis unpunched can be supplied for any of above.

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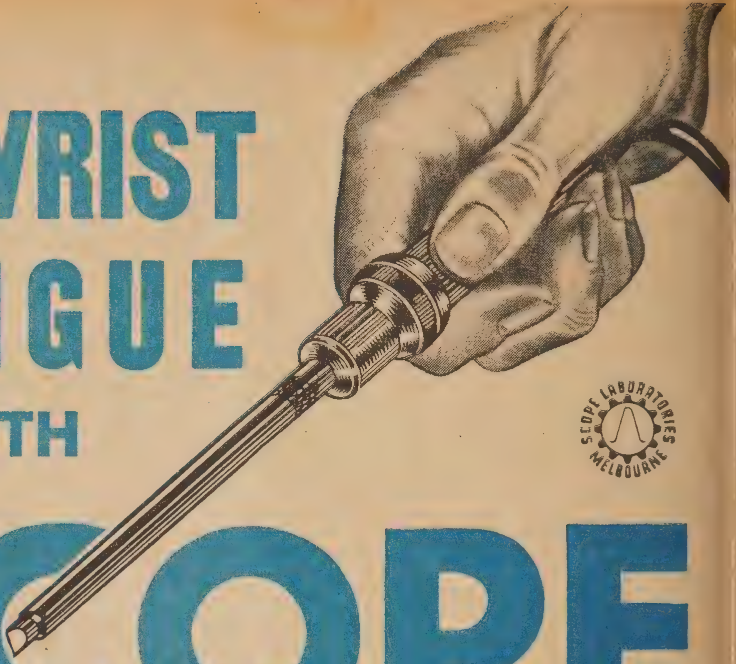

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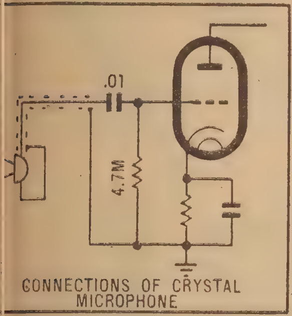
OW TO GET YOUR MATEUR LICENCE

(Continued from Page 57)

ncy filtering system is often required addition to the low frequency filter rder to prevent spurious signals being cted into the equipment.

ESTION 9.

) The Critical Frequency is the high- frequency which, when transmitted ically upwards, will just fail to be cted from the ionised layers above earth.



pical connection for a crystal microphone.

) The Maximum Useable Frequency a specific distance is the maximum uency which can be used to transmit that distance.

) The Optimum Working Frequency at frequency which gives the greatest e strength consistent with reliability a specific distance. It is usually ulated as 15 per cent lower than the F.

) At times, generally during the sum- period, clouds of intense ionization ear in the E-layer, and these can e extended reception paths at fr- ncies approximately between 25 and Mc. On nature they are highly vari- and are known as sporadic E-layer ation.

Microwave Link

(Continued from Page 13)

ween repeat points, using standard equipment on a frequency of 165 acycles. This enables technicians to municate without interference to the picture.

ecause of the narrow beam radiated the dishes, careful lining up with essive repeat points was needed. This carried out initially using compass ings, and once communication had established, final adjustments were le by normal methods.

he importance of this telecast does stop at the success achieved. It de- nstrates the practicability of such s to extend the range of TV networks ughout the country, something of l importance in the development of art.

demonstrates, too, that Australian neers are not lagging behind the rest the world in their ability or initiative.

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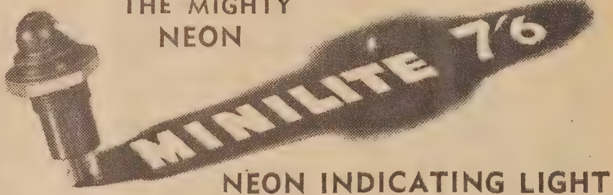

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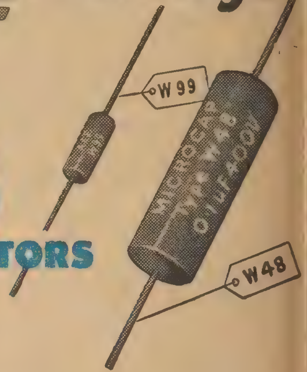
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NEW LIGHT ON THE VCR97 CR TUBE

ecent experiments in our laboratory indicate that many VCR97 athode-ray tubes, hitherto written off as "duds" may, in fact, be just e reverse, and capable of giving very bright six-inch television pictures. This should be good news for many TV set builders.

E facts of the case were unearthed recently, nore or less by ac- t. when a tube which we had every n to think was good, failed to op- satisfactorily in our prototype 6- receiver. By the time we were fin- with it, however, it was producing ly focused pictures, bright enough atch in a well lighted room.

published data we had been able d on the VCR97 showed it as a ntional 6in electrostatic tube, iden- or very similar to the Mullard 60. Typical tubes from disposals es seemed to confirm this infor- n, since they operated with the base connections and the same ed potentials as the above ment- commercial type.

e only complication was a vague nce in an English magazine to a ction for "Internal Coating" along- he Y2 deflector plate. This was in- stent with the ECR60 and sample on hand, where the internal coat- as tied apparently to anodes 1 and onnecting a potential to the sup- "Internal Coating" certainly made sible difference to the trace.

cordingly, in the data published in November, 1957 issue, we made no l provision for the internal coat- lthough it was shown as a possible ction to the socket.

OR" TUBES

other pin, alongside the heater lug, shown as vacant and we suggested t it could conveniently be used as chor point for the heater dropping or. The prototype receiver was wir- is way, the sample tubes worked ll seemed well until this supposedly VCR97 failed to focus.

ecalled immediately other VCR97's d heard about which likewise fail- focus, or were variously written "low emission" or "out of line."

a purely exploratory measure, we the heater junction off the anchor- n and were immediately rewarded eing the beam brighten and jump t into focus. Very obviously, the psedly vacant pin was occupied. Nor merely an internal tie-point, be- s there was no sign of any initial ial on it.

plying a proportion of the EHT e brought a further improvement e trace, showing that an active ode of some description was in- vl.

cisely the same thing happened for ther supposedly vacant pin, but had been hinted as a connection e internal coating.

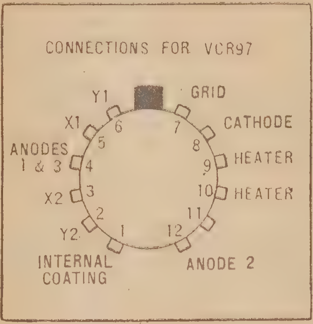
the time the full EHT was ap- to both pins, the focus was good e beam brighter than any VCR97 BP1 that we had previously seen

ed with this rather surprising re- we proceeded to collect a number R97's for closer examination. By ing the two screws holding the base plate, it became quite evident that there were two distinct versions of the tube, one with two completely blank pins as per the ECR60 and the other with internal connections to all pins.

Further investigation brought to light someone who had worked in a local laboratory on radar equipment. He recalled that later versions of the VCR97 did have amended base connections but no data for them had ever arrived. The standard amendment was to tie both hitherto vacant pins to the EHT point, along with anodes 1 and 3, just as we had done.

The rest of the story was revealed when we came across a tube in which the internal coating covered little more than the glass flare, leaving most of the gun and deflection structure visible.

The newer tubes have a completely different and well-finished electrode structure. The vacant pin alongside the heater is a separate connection for A1, while the pin alongside Y2 goes to internal coating and a post deflection anode.



All samples of the newer tube in our possession are distinguished by the fact that the neck is 2-13/16in wide against 2½in for the earlier type. Also the additional leads to the hitherto vacant pins can be seen by removing the base cover plate at the end of the tube.

Whereas the older tube has simple flat deflector plates, the newer version has formed plates shaped rather like shallow dishes.

The accompanying diagram shows the base connections for the earlier VCR97, as given in our November issue.

For the newer tube, the internal coating should be tied to anode 3, shown in our diagram as pin 4. We have reservations about connecting A1 to this same point because, even though it gives a very bright picture, it may prejudice tube life.

Lacking definite information, it may be safer to apply not more than 1,000 volts to it, picked off about halfway along the divider system.

By wiring the socket as indicated, either version of the tube can be plugged in, the additional leads being simply redundant for the earlier type.

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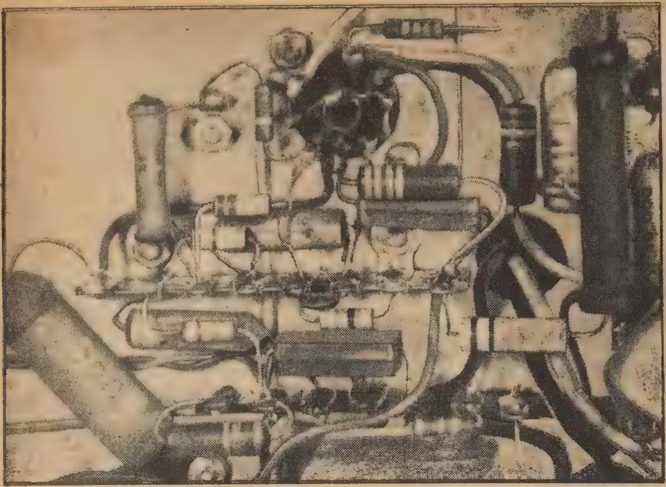


This detailed photograph shows how the components for the amended synch. separator circuit fit around the 12AU7 socket. The changes can be completed in a couple of hours.

Some Improvements to Synch. Separators

Recent work by the Applications Laboratory of the Amalgamated Wireless Valve Company has shed some interesting light on the operation of synch. separation stages. An amended circuit resulting from this work shows advantages over the previous arrangement and details are given for those who may care to try it in the R. TV. & H. 17-inch and 21-inch TV receivers.

IMMEDIATE object of the research was to investigate reasons why some television receivers tend to show a slight bend in vertical lines near the top of the picture.

The possibility also existed that generally better synchronising characteristics could be obtained for both frame and line oscillators, without sacrificing the essential simplicity of the earlier arrangement, suggested by the laboratory and adapted for use in the R. TV and H. receivers.

OPERATES AS CLAIMED

The new circuit has been checked in the original 21-inch receiver and operates almost exactly as claimed. It can be substituted quite simply for the original wiring and is well worth a trial in special cases where picture bending is evident or where some improvement may be sought in picture interlace.

We shall have more to say later about the necessary wiring changes, but some preliminary discussion of the problem as a whole may be helpful.

To understand the significance of synch. separation to vertical edges, interlace and other picture details, it is necessary to recall the relationship of the synch. pulses to the operation of the scanning oscillators in a TV receiver.

At normal settings of the "Vertical Hold" and "Horizontal Hold" controls, the vertical and horizontal oscillators have a natural period of oscillation which is slightly longer than the standardised frame and line intervals. Thus. when the receiver is tuned to a blank channel. the raster contains less than the normal 50 fields and the total number of lines per second of display is somewhat less than 15,625.

When a station is tuned in, the synch. pulses trigger each oscillator slightly before the end of its natural forward stroke, thereby reducing the period of each cycle and increasing the num of cycles per second to 50 and 15, respectively. Synchronism is thus est lished between transmitter and recei

Two situations can arise to upset proper state of affairs:

(1) Any spurious signal reaching oscillator before the regula syn pulse, can trigger the oscillator ea so that it commences its retrace the following forward trace too so The picture information which belo to the forward trace is therefore placed in relation to the picture a whole.

(2) If a synch. pulse is lost for reason, the oscillator does not trig till the end of its natural period. retrace and the following forward tr therefore occur too late and the relev picture information is once again placed.

Very slight irregularity of the fra oscillator and consequent displacem of information is evident as a lack or variation in interlace. More seri irregularity can cause frame jitter wh by, even though the picture is loc as a whole, it appears to jitter up down by a distance equal to sev lines.

NO GREAT HAZARD

By and large, external interfere signals do not present any great haz to the frame oscillator, because the cuits which separate and amplify frame pulse tend automatically to criminate against transient interfere pulses arriving via the regular sig circuits.

However, as we have pointed out other articles, the chief hazard to frame oscillator arises within the ceiver itself, when high amplitude pu from the line deflection circuits pe trate the frame oscillator and caus to trigger at irregular points along slope of the frame pulse 'integra curve.

A small amount of line freque penetration will prejudice the inter so that it can only be maintained careful adjustment of the Frame H control. More penetration than this make it impossible to observe any in lace effect, no matter how critically Frame Hold is adjusted

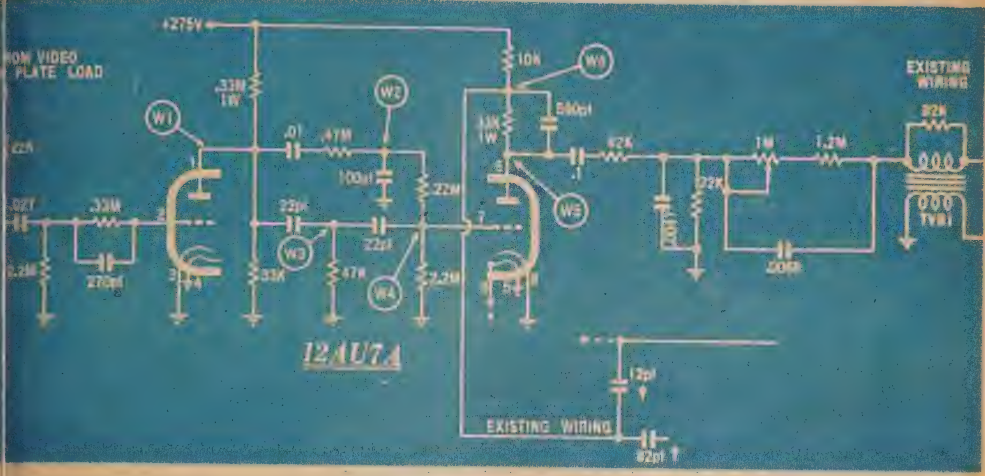
Gross leakage of line energy into Frame Oscillator can cause the fr jitter referred to earlier, because frame oscillator tends to trigger on one of the line flyback pulses occur adjacent to the frame synch. bl Such jitter is affected but not prev ed by critical setting of the Frame H control.

The obvious step in either c whether jitter or merely poor interl is to examine and rearrange the wi and components to minimise the l age of line deflection energy into Frame Oscillator. This is a first essential requirement.

BETTER FRAME PULSE?

If, as a second step, the nature

AMENDED SEPARATOR CIRCUIT FOR 17, 21in RECEIVERS



e is the amended circuit diagram. The second triode section needs to be completely rewired, also the input circuit to the ne oscillator. The input circuit to the first 12AU7 grid need not be altered, apart from the substitution of a larger coupling capacitor (.01 to .03 mfd) from the .0022 used in the original 17-inch receiver.

Frame Synch. pulse can be im- d, so much the better.

om a simple integrator, the pulse relatively slow build-up time ex- ng over possibly 2½ lines and there be some doubt as to the exact on the slope on which the frame ator will trigger. Under these con- s, slight additional voltage due to synch. or line deflection may in- e the exact triggering point.

y provision which will steepen the of the integration curve must ren- these spurious voltages of lesser quence and therefore contribute to interlace.

much for the frame circuit. Be- the line oscillator must respond e very brief line synch. pulse, it ually likely to respond to transient pulses or even to be affected by ackground noise behind weak sig-

y noise which thus affects the line ator may cause it to trigger before ynch. pulse proper, displacing the quent forward trace and/or the e information distributed along it. effect on the picture is something he familiar noise "snow" but more s in that, along with any noise nt which the picture may contain, is a random sideways jitter of or all lines.

ereas noise can cause premature ring of the line oscillator, the acci- l loss of one or more synch. pulses lelay triggering and again produce cement of lines and/or picture in- tion.

e problem is so serious in relation e line circuits that all but the elementary receivers, these days, ome form of automatic frequency ol for the line oscillator.

CONTROL VOLTAGE

tems vary but the general idea is mpare the repetition frequency of the incoming line synch. pulses with the line scan circuits in the receiver and produce a dependant DC voltage. This involves a gating or discriminator system.

The DC voltage serves to vary the frequency of the receiver's own oscillator, so that it automatically remains in step with the incoming synch. pulses.

The control circuit is deliberately given a fairly long time constant so that the oscillator cannot change frequency in response to a single spurious impulse. Random noise voltages are largely ignored or averaged out, the control circuit deriving its voltage almost exclusively from the regular train of line synch. pulses.

Even the loss of a line pulse makes little difference, because the influence of a single pulse on the control voltage is slight and the oscillator maintains almost exact synchronous frequency, ignoring the lost pulse just as readily as a spurious one.

But—and here is the vital point—if a succession of line pulses should be lost, the control voltage will inevitably change and the oscillator begin to drift to its free-running and normally slower frequency. Picture information will be progressively displaced as the line frequency drifts from synchronism, causing vertical lines in the picture to bend.

Conversely, when the line pulses reappear after such lapse, the control voltage gradually changes to restore the line oscillator to correct frequency, again producing picture bend.

LINE HOLD CONTROL

The amount of picture bend which becomes evident in these circumstances is dependent to a degree on the Line Hold control setting, which influences the frequency to which the oscillator drifts, when the synch. pulses disappear and the control voltage alters.

Thus, in many cases, the Line Hold control can be manipulated to reduce picture bending by the simple device of bringing the oscillators' natural period very close to the synchronous frequency. However, in this condition, the oscillator's natural flyback may easily anticipate the line sych. pulse, making sychronism uncertain as the bend disappears.

Again, even though the oscillator may remain locked on a given Channel, it may not readily lock when switched from Channel to Channel, if the Line Hold control is set too critically, to maintain vertical lines.

With a system employing negative modulation, line pulses can be lost or drastically reduced in amplitude by an overload condition in the receiver and a good many picture bending and tearing troubles are traceable to this cause.

Because it involves a sustained period of high signal amplitude, the frame synch. and retrace portion of a television signal is particularly critical and may emphasise any marginal condition likely to affect synchronisation.

Work by the A. W. Valve Applications Laboratory has shown that over and above effects elsewhere in the receiver, line synch. information can be lost or diminished in the synch. separator itself during the frame pulse block.

The loss is particularly likely to occur where extreme clipping action has been sought and is further affected by the time constants around the circuit and the pulse separation networks.

It may not be readily visible—if at all—on ordinary TV oscilloscopes but can readily be seen on elaborate types where segments of line information can be selected from a total field and viewed in detail.

Under such scrutiny, as the frame integration curve builds and collapses, the line pulses may be seen, in some cases, to reduce in height or even disappear temporarily.

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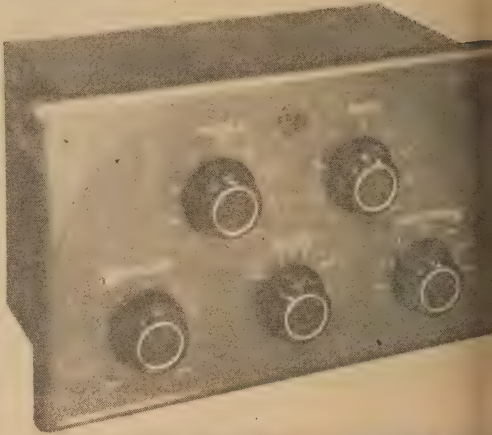

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obbed of synch. pulses in such a , the line frequency control circuit vs the oscillator to drift, then re- es it to synchronism when the pulses pear. The initial drift is not visible he screen because the spot is blacked but the recovery may not be com- before the next picture begins— e the bending at the top of the ire.

would appear that the effect in the nal 12AU7 synch. separation cir- is quite marginal, because picture has only been evident in a min- of cases. Presumably the circuit ances in such cases have conspired ender it so.

E MODIFIED CIRCUIT

ne modified circuit suggested by the ications Laboratory is aimed at re- ing this hazard and ensuring that synch. pulses will always be present. tionally, the frame pulses have improved, so that some benefit can be expected in relation to interlace. the modified circuit, the first tri- section of the 12AU7 operates as pper/amplifier, being almost identi- o the original circuit.

om the plate circuit, the synch. in- ation is passed without further clip- into separate integrating and dif- tiating networks. The time con- , in each case, has been chosen ully to give the best possible sep- on and pulse shape.

a more complex system, the pulses t thereafter be fed into quite sep- valves for further amplification or clipping. However, it has been possible to arrange the operating itions of the second 12AU7 triode that the two sets of pulses can be ed to its grid and amplified with- serious overload, so that both ap- in the plate circuit.

D LOAD RESISTORS

e plate load involves two resistors ries, one of them bypassed by a F. capacitor.

the line frequency the resistor/ itor combination has very low em- nce, so that line frequency energy veloped only across the remaining 0 ohm resistor.

th resistors are effective for the pulse, however, allowing a much r pulse voltage to be developed, a sharply rising front. The value is was explained earlier in the art-

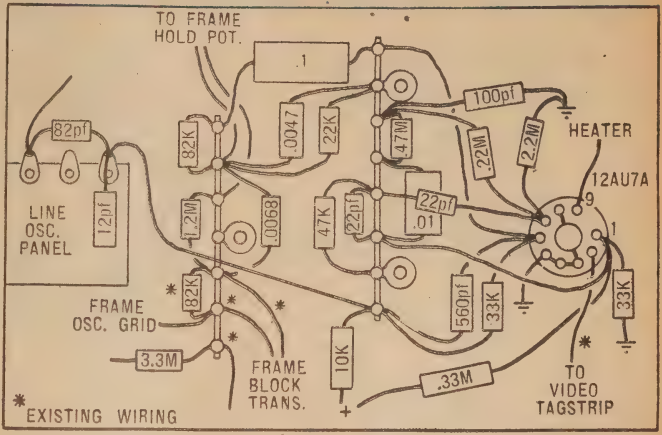
cillograms copied from the original Co. data show that, under typi- onditions, the frame synch. pulse a peak value of 95 volts and the pulse 36 volts.

om the take-off points in the out- plate circuits, the signals are div- through simple coupling networks ne frame and line oscillators, as n.

substitute the amended circuit for original in the R. T. and H. re- rs is a relatively simple matter and gested component layout is shown e accompanying diagram.

e integrating components can be ved from the first three lugs on the ant 7-tag strip, together with the to the Frame Hold potentiometer. ve the 3-tag strip supporting the eg resistor in series with the pot. all the components attaching to the second triode of the 12AU7 synch. separator. Some of these can be used again.

WIRING OF THE NEW SEPARATOR



The components can be arranged neatly and systematically if wired as shown above. The 7-tag strip to the left should already be in the chassis. The 8-tag strip needs to be added in the approximate position shown.

NEW TAGSTRIP

A new 8-tag strip should now be mounted in the vacant space alongside the 12AU7 socket and the wiring and parts put in as shown.

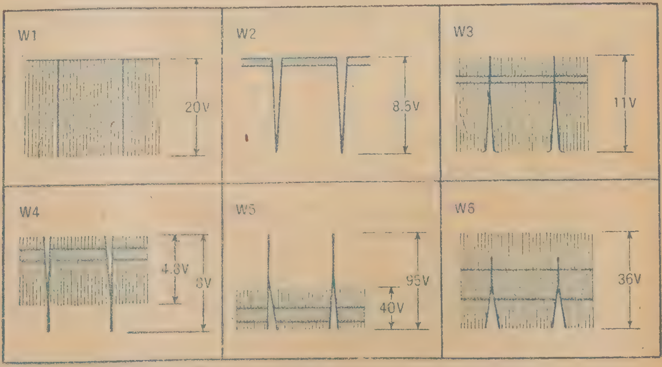
There is no need to disturb the video input wiring to the first 12AU7 grid. The sequence of components feeding the grid is different but this will not affect the end result and there seems to be no point in disturbing the present wiring.

Note that the main blocking capacitor is now shown as .027, as compared with .0022 in the 17-inch receiver and .01 in the later 21-inch version. It was suggested at the time that this latter value be used in all receivers and it would still appear to be adequate. However, the larger value could be substituted for another .01mfd wired in parallel, if readers so desire.

As we said earlier in the article, the circuit appears to work well and deliver the kind of pulses claimed for it. As it happened, neither of the receivers available for immediate test has suffered to any degree from picture bending or lack of interlace and therefore offered little indication as to the potential value of the circuit in a receiver where these things are a problem.

Individual readers may, however, welcome the opportunity to try the circuit and it is offered for this reason. We would likewise welcome any reports regarding the result of such trial.

(Continued on Page 121)



Typical waveforms at various points as marked throughout the circuit, taken with the receiver in normal operation and with a picture on the screen. The waveforms were copied from original Valve Company data but were duplicated fairly closely in our own receiver.

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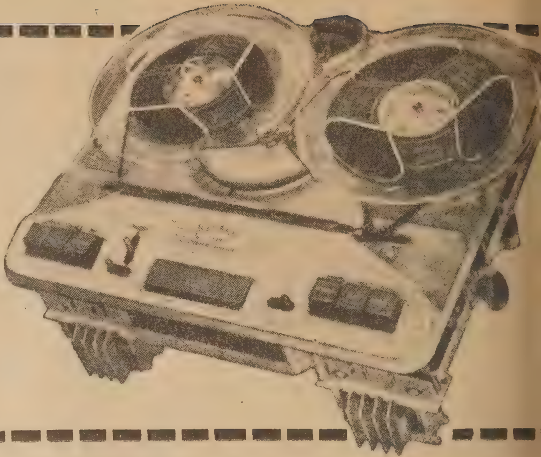

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A COURSE IN TELEVISION

PART 29 — SAWTOOTH OSCILLATORS (Cont.)

his is a continuation of the article in last month's issue on sawtooth deflection oscillators. aving discussed basic principles and the operation of gaseous discharge valves, we pass o a discussion of the various "hard valve" oscillator circuits, with particular reference to the Miller-transitron oscillator.

ENTION was made in the last article of the linearising pentode, nonly used in association with gas large oscillators, and a brief ex- ation of the idea may be appro- e at this point.

tually neither the gas discharge nor linearising pentodes find much cation—if any—in modern televis- receivers. However, they appear iently in test oscilloscopes and l conceivably be used in elemen- receivers using oddment valves and rostatically deflected cathode-ray . Some mention is therefore war- d, for the sake of completeness.

N-LINEARITY

e gas triode oscillator circuit shown month as figure 159 is subject to same basic non-linearity as any e charge-discharge circuit. The n for this, as explained by figure lies in the fact that the charging nt into the storage capacitor tends crease as the stored potential rises rds the supply potential.

earity can be improved by restrict- the voltage excursion across the ge capacitor, or by using a very supply potential or by connecting device into the charging circuit will maintain the charging cur- substantially constant.

is statement is quite fundamental although associated here particu- with gaseous circuits, applies with force to other charge-discharge ts producing sawtooth waveforms.

ure 161 shows a typical combina- of gas triode oscillator and linearis entode.

re the pentode, which can be rdinary RF amplifier type, is con- d in series with the cathode return e gas triode. Either the negative e positive side of the supply can rthed, as required, but due care is sary in either case to avoid apply- n excessive peak voltage across the r-cathode insulation of the indivi- valves.

E IONISES

ring the initial cycle of operation, raws plate current and, by so doing, s up a voltage across the timing itor "C" and therefore across the ube VI. In other words, the lower of "C" in the drawing is made ally negative with respect to the plate.

en the potential across the capaci- nd across V2 reaches a certain criti- alue, the tube ionises and abruptly arges the capacitor. This action s the plate of V2 once again to h positive potential and the charging action commences once again, the cycle of events being repeated infinitely.

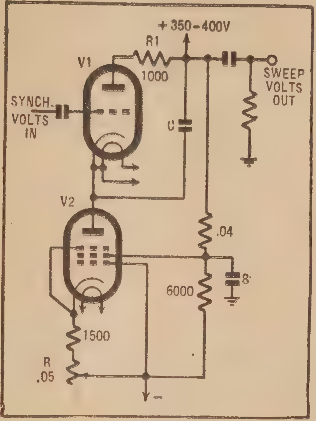

Figure 161: Typical interconnection of a pentode and gas triode to give a more linear sweep. The same principle can be applied to other oscillators.

The rate of charge into the capacitor "C" is actually dependent on the plate current of V2, since V2 provides the negative return path for the whole gas triode circuit.

It is characteristic of a pentode that the plate current is largely independent of plate voltage, being governed more by the standing screen and bias potentials.

In this circuit, the screen potential is held steady by a divider network across the high tension supply. The bias is adjusted in the cathode circuit, the two quantities together setting the plate current of the tube.

As already stated, this remains substantially constant at the preset figure and maintains a fairly constant charging current into capacitor "C." As a result, the build-up of voltage across "C," representing the forward timing trace, is made more linear.

While the pentode can thus contribute materially to linearity of the forward trace, it can effect no improvement to the rather poor retrace characteristics of the gaseous oscillator, due to the latter's rather uncertain ionisation and deionisation and its significant internal impedance.

As a result of these limitations, gaseous oscillators find little or no current application in modern television receivers, preference being for so-called "hard-valve" circuits—those using conventional vacuum types.

Such valves lack the inherent ionisation characteristics of the gaseous types and therefore the ability to function as a simple relaxation oscillator. Special measures are normally necessary to bring about an abrupt change in valve impedance sufficient to discharge the associated timing circuit.

SYNCH. PULSES

Possibly the most elementary form of hard valve time base is illustrated in figure 162.

Here the valve is supplied with appropriate plate and screen potentials, but with a standing bias sufficient to maintain it beyond plate current cut-off.

In this condition, capacitor C is charged through R, the rate and degree of charge depending on the circuit constants.

When the synch. pulses are applied to the grid, each positive-going pulse causes a burst of plate current to flow, or, put another way, it momentarily lowers the impedance of the valve. This discharges C at each pulse, the charge tending to build up again during the intervals.

The system was used in a few early overseas receivers, but it suffers from certain very serious limitations

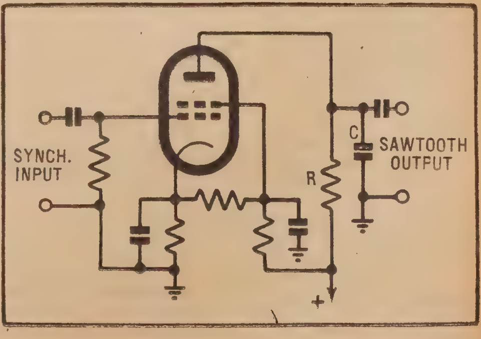

Figure 162: An elementary sawtooth generator actuated by the synch. pulses. It ceases to operate in the absence of signal and may cause damage to the screen of the picture tube with a set designed for negative modulation and having a mains type or RF EHT supply.

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COPY OF REPORT RECEIVED FROM THE ELECTRONICS DIVISION OF SYDNEY'S MAIN TV MANUFACTURER

10th February, 1958.

MR. BELL,
R.C.S. Radio Pty. Ltd.,
651 Forest Rd.,
BEXLEY, N.S.W.

Dear Mr. Bell,

Referring to the R.C.S. Combined video and sound strip No. submitted to us for examination and comment, we found the strip perform very well indeed.

When a Philips tuner was connected to it the IF primary (on tuner) was adjusted to 32.5Mc/s for a good pass band. The amplit kept its pass band shape under varying conditions of bias and sig strength, which is a clear indication of the absence of feed back effe No evidence of overload was present even under strong local signal c ditions (approx. 250mV from Channel 9). Coupled into a receiver picture quality was good. The pass band of the strip was substantially with a band width of 4.5 Mc/s between the 6dB points. This compa well with the best commercial receivers.

With threevolts bias on the A.G.C. line the IF strip showed a m band sensitivity of 2mV at the first IF grid for 1 volt DC at the vis diode. With no bias on the A.G.C. line the sensitivity was approximat 40mV and the amplifier quite stable.

Built according to the sample described the strip could be used build a receiver of the highest standard of performance to compare fav ably with any commercial receiver on the market.

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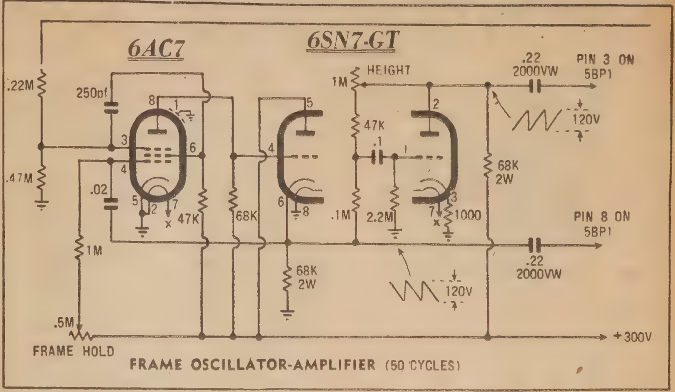

Figure 163: This circuit, extracted directly from our 5-inch electrostatic television receiver (September 1957), shows the basc Miller-transitron oscillator (6AC associated with a cathode follower to shorten the retrace period and a triode phase-inverting deflection amplifier.

he first place, the synch pulses e of large and consistent ampli ince they control the whole dis period of the tube rather than acting as a trigger. The compli of supplying such pulses may well ater than that of installing a more te timing circuit.

irther point is that the oscillatory and therefore the whole scanning depends entirely on the presence nput signal. A break in transmis detuning the receiver would re all deflection, allowing a station ot to rest in the centre of the This assumes, of course, that the voltage is obtained, as was the old-style receivers, from a mains mer or RF supply.

ERN SYSTEM

oint of fact, modern receivers in secure their EHT supply from scan circuits, which are driven by a continuously running fre controlled oscillator. This secures all economy of design, ensures screen area is scanned at all nd also renders the line-scan cir least, less liable to interference oise pulses.

idea of pulse-operated scanning is quite foreign to this modern h.

der to meet modern requirements make a hard valve (i.e. a normal type) act as a self-excited saw scillator, it is necessary to pro positive feedback path around it. be done in a variety of ways, g the use of a feedback trans a phase-reversing valve, or net r the use of some negative trans ance characteristic.

ig induced a self-oscillation, the and frequency of the output m can then be modified by the of resistance-capacitance net t appropriate points in the circuit.

last statement may seem so gen to mean very little, but the force ould emerge as the discussion s.

163 shows the frame oscillator/ r for a five-inch electrostatic re as described some months ago journal. Significant portion for ent discussion is the 6AC7 and cent half of the 6SN7-GT, which form a Miller-transitron oscil d discharge valve.

erm "transitron" occurs in the ause the circuit makes use of sitron or negative transconduc fect between the suppressor and f a pentode valve.

ICTED USE

ircuit is not commonly used in cial television receivers, but it d itself to simple home-construc rostatic sets and it is also used scilloscopes.

tion of the circuit is rather in but the broad principles can ined as follows, using the sim asic circuit of figure 164:—

tode valve, connected as in this will generate continuous out pproximate sawtooth waveform.

ler the condition at an instant he cycle when the plate cur the valve is cut off No cur ws through resistor Ra., there oltage drop across it and the valve anode, along with one plate of capacitor C, is at the same potential as the high-tension line.

The other plate of capacitor C is held very close to earth potential due to the diode action between grid and cathode of the valve. Conditions therefore exist for a maximum charge to be present across C.

MUST DRAW CURRENT

The condition just described obviously cannot be sustained because a valve with potential on plate and screen and near zero volts on the grid must draw plate current. Assume, therefore, that plate current begins suddenly to flow, as one would expect.

Immediately it does, a voltage drop occurs across the load resistor Ra, causing a negative-going shift in anode voltage. This shift is not confined to the anode, however, because the coupling capacitor C communicates it also to the grid, driving the grid sharply negative.

Fairly obviously, this abrupt negative excursion of plate and grid cannot have an amplitude of more than a few volts because any greater negative grid excursion would interrupt plate current and terminate the effect.

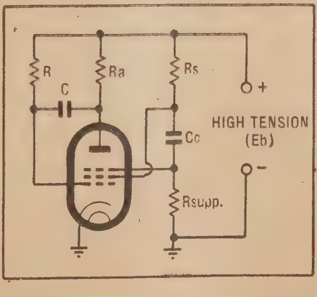

Figure 164: To assist in understanding the Miller-transitron oscillator, this diagram should be studied in conjunction with the text and the waveform diagram overleaf

What happens, rather, is that the grid potential falls abruptly to a point just short of cut-off, after which further changes in bias and plate current take place much more slowly.

Another important point is that, with the grid now negative, there can be no grid-cathode conduction and resistor R is the only path through which capacitor C can discharge.

This it proceeds to do, immediately following the brief transient just described. As C discharges, the junction of C and R tends to move towards the B-plus line potential, carrying the grid from near cut-off towards zero bias.

OPPOSING ACTION

However, the grid cannot be subject to a positive-going signal without increasing the current through Ra, therefore tending to lower the plate voltage. This downward movement of plate voltage is naturally communicated to the grid through the reactance of C, opposing the tendency of the grid to move in a positive direction.

The ultimate rate at which the potentials can change is therefore dependent on the storage effect (i.e., the capacitance) of C, the resistance of R, and the modifying effect of the valve as just described.

The effect of the valve is quite profound, the natural discharge curve of R and C being subjected to what might be regarded as a "negative feedback" effect. As a result, the discharge curve becomes a substantially linear function.

Furthermore, while the discharge rate can be controlled by varying either C or R or both, the order of values required may differ from other circuits because of the modifying effect of the valve.

The gradual and linear discharge of C through R, and the dependent shift in plate potential, is commonly referred to as the "rundown" period and would provide the forward scanning trace in an oscilloscope or TV receiver.

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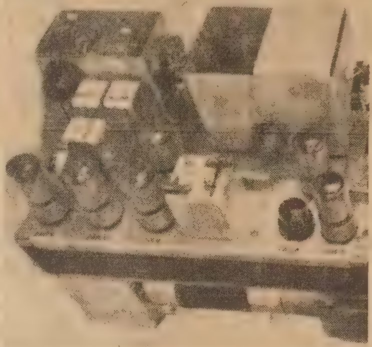

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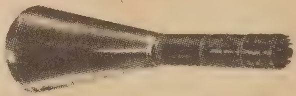

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.005	2500	Block	2/
.01	2000	Mica	2/
.01	5000	Block	4/
.01 and .01	2000	Block	3/
.01 = .001 + .005	600	Block	1/
.015	2000	Mica	2/
.02	1000	Mica	2/
.02	2000	Mica	3/
.025	2000	Mica	3/
.1	500	Block	1/
.1	1500	Block	2/
.1	2000	Block	3/
.25	1500	Block	/
.25	3000	Block	3/
.5	750	Block	2/
.5	8000	Block	4/
1	400	Block	2/
2	400	Block	3/
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hat of the automatic recovery and ce action necessary to make the t repetitive? This involves the nega ransconductance property previously red to.

uring the run-down period the screen ntial does not undergo any import- changes. However, when the plate ntial falls to something equal to or than the screen potential, screen nt increases sharply, resulting in a en downward movement of screen ge.

is is communicated to the suppres- ia Cc, the suppressor therefore be- driven negative, further increasing n current and decreasing plate cur- The effect is cumulative and quite ot, so that plate current is suddenly substantially cut off.

NDITIONS MUST CHANGE

r a brief interval, therefore, the is left in a condition of very low n voltage and a substantial negative on the suppressor, these conditions ng to change before plate current commence to rise again.

ring this delay period, C has an rtunity to charge via Ra and the cathode conduction path, the plate ge rising simultaneously toward the upply potential. When plate, screen suppressor voltages are such as to it plate current once again to flow hole cycle repeats itself.

ure 165 shows the voltage wave- s throughout the cycle. In the "Ea" , representing plate voltage, note nitial brief transient, the rundown and the charging curve as the voltage rises again toward the s potential.

The time constant of the screen and essor circuit, involving particularly must be chosen with due respect to esigned operating frequency. If Cc small, plate current will flow be- anything like the full charge has red across C, thereby reducing ive output. If Cc is too large, the e-recovery time will be unneces- long.

point of fact, long flyback time weakness of the Miller-transitron t, and a cathode-follower discharge may be used in association with overcome this difficulty. This func- is performed in figure 163 by the section adjacent to the 6AC7.

plate of the pentode is coupled ly to the grid of the triode, which load resistor in its cathode circuit. dinary follower action, the cathode times assumes a potential close at of the grid, and therefore to AC7 plate.

IMPEDANCE

important difference is that the de circuit has very low apparent lance, so that, during the recovery back period, the capacitor C is not ed through a 68K resistor in this but from the very low effective t impedance of the 6SN7-GT de, amounting probably to less than ohms. This makes the flyback time nely short.

ite a substantial sawtooth voltage ailable across the cathode circuit, almost equal to the plate excursion may, in turn, have a peak-to-peak only slightly less than the HT voltage.

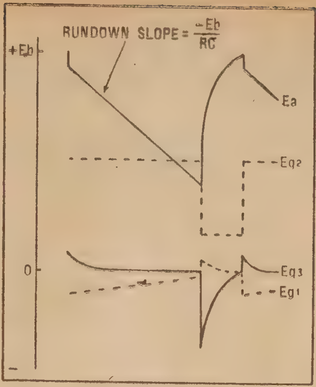

Figure 165: This diagram illustrates fairly closely the change in potentials of the Miller-transitron oscillator, plotted against time. Note the transient at the start of the run-down slope (Ea) and the following rise in plate voltage preparatory to the next cycle.

receiver to swing one deflector plate directly, the other plate being fed with an out-of-phase signal provided by the second half of the 6SN7-GT in figure 163.

Summing up, the Miller-transitron oscillator is characterised by excellent forward linearity, a very fast retrace if used with a cathode follower and high peak-to-peak output volts

The constants can be proportioned readily to allow operation at either frame or line frequencies in a television receiver, or it can be used as a variable frequency sweep for oscilloscope work, provided provision is made to vary the suppressor/screen time constant as well as the basic C/R components in the plate/grid circuit.

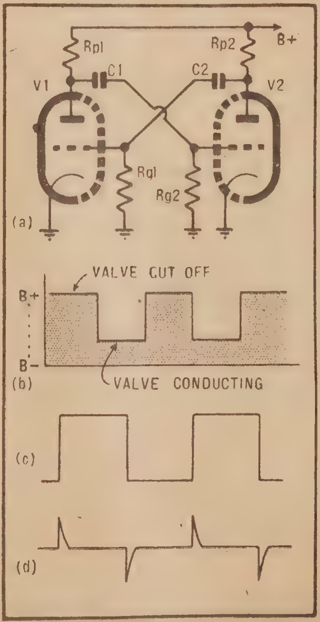

Figure 166: Illustrating the basic principles of the multivibrator. The circuit is shown at (a) and plate voltage changes in (b) and (c).

It locks best with negative-going synch. pulses, but these need to be of much higher amplitude for reliable locking than for most other types of saw-tooth generator This is something of a disadvantage.

Another type of oscillator, which is very frequently used in television receivers for saw-tooth waveform generation is the so-called "multivibrator."

WELL-KNOWN CIRCUIT

The basic current arrangement is very well known in the radio and electronic art.

Multivibrator circuits, or their variants, have been used in AF and RF test equipment for signal generation, in electronic musical instruments, electronic switching circuits, in frequency multiplying and dividing equipment and in electronic computers, to mention just a few of the many and varied applications.

A simple multivibrator circuit takes the form shown in figure 166(a) involving two triodes, commonly the two sections of a twin triode valve. Each has a plate load and a grid return resistor, the plates and grids being cross-coupled by capacitors as shown.

Since each triode section amplifies any signal applied to its grid and inverts the phase through 180 degrees, a signal passing through both tubes is amplified substantially and changed in phase by 360 degrees. This constitutes a high degree of positive feedback, rendering the circuit unstable and therefore capable of self-oscillation.

STARTING CYCLE

Assume, in figure 166, that a positive potential is present on the H.T line when the cathodes begin to emit. Since it is virtually impossible that the two triodes shall be exactly balanced, the rise in current to one triode will inevitably take place sooner or be more rapid than to the other.

Assume that V1 conducts a trifle more

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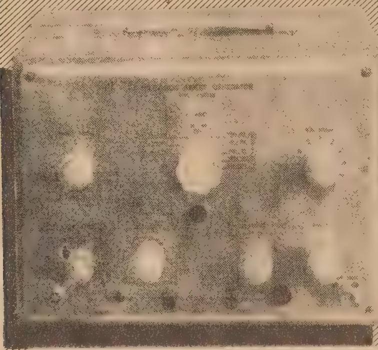

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readily than V2. Its plate voltage
fall more rapidly, as the current thr
the load resistor rises, thereby appl
a greater negative-going signal to
grid of V2 via C1, than is applied t
own grid through C2. This puts V
a disadvantage, so that its natural
in plate current is further retarded

Actually the effect is cumulative
the negative-going signal on the gri
V2 soon reverses the tendency fo
plate current to rise. Instead, cu
falls and the plate voltage rises
to the B-plus potential, feeding a
tive-going signal through C2 to the
of V1.

In the ultimate, V1 with a pos
going signal on its grid, draws the
mum current which the valve and c
constants will permit. Simultaneously
with a large negative-going signal o
grid, is cut off.

UNSTABLE CONDITION

This condition cannot be sust
because, with no further movemen
plate voltage. there is no "signal"
able to the grids. These both
towards earth potential at a rate gove
by the capacitance values of C1 an
and the resistance of Rg1 and Rg2.

After a period determined largel
the time constant of C1 and Rg2
grid of V2 reaches a potential
will allow V2 to draw some plate cu
Immediately it does, the plate vo
of V2 commences to fall and a neg
going signal is applied to the gri
V1.

This augments the falling tenden
V1 plate current, due to the disap
ance of the former positive-going
on its grid. Instead the falling
current allows the plate voltage o
to rise, applying a positive-going
to the grid of V2.

Since the effect is cumulative,
driven rapidly to plate current s
tion, V1 is completely cut off an
plate voltages again become stati
while the grids gradually drift
toward earth potential. So the
continues to repeat itself.

Diagram (b) indicates the chan
plate voltages for the respective t
one conducting while the other
off. Diagram (c) represents the sq
waveform which is available at
plate while (c) shows the type of
form which can be produced i
original squared form is passed th
a differentiating network

BALANCE NOT ESSENTIAL

Figure 166 assumes the use of a
triode and also balanced circuit
stants. Neither assumption is fund
tal to the operation of the circuit.

In point of fact, the two valves
be dissimilar and contained in e
separate envelopes. Furthermore,
coupling components may be far
balanced. Just as long as there is
cient gain within the total feedback
the circuit will oscillate in some fa

A lack of symmetry in the co
components simply produces a la
symmetry in the output waveform
conducting and non-conducting p
of the two valve sections being
similar.

By the same token, other meth
coupling can be used between the
as, for example, cathode couplin
more will be said of this in a later a

(To be Continued)

APPLICATION OF THERMISTORS

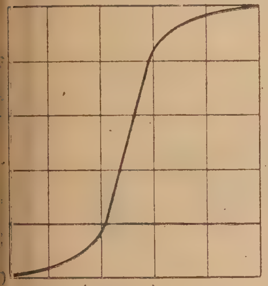
ermistors are particularly useful devices, and have many valuable applications in electronic uipment. This article, by Aerovox, presents some practical information on their employment in a variety of designs.

ts name implies, the thermistor a thermally-sensitive resistor. It a non-linear resistor. Although it -terminal semi-conductor device, rmistor is not a rectifier. It accor- may be employed in either AC circuits.

mistors are manufactured in a r of shapes, principally beads, and rods, and in variation sizes ng subminiature.

basic property of the thermistor hange of resistance with tempera- he temperature change affecting arise externally or it may result urrent flowing through the therm- This property gives rise to the arity of the thermistor resistance eristic.

mistor action may be employed ral ways to modify the behaviour trical circuits. Many applications dered especially attractive by the



ERMISTOR CURRENT-TIME CHARACTERISTIC

FIG. 3

ty of the thermistor and its com- s. A number of typical applica- e described in this article.

es 1, 2, and 3 illustrate typical or characteristics.

e 1 displays a non-ohmic varia- resistance with temperature. From ve, the resistance of this parti- nit is seen to decrease over a of aproximately 2,000 to 1 for rature increase from -60 to -150 C.

e 2 shows the static El charac- of the thermistor. This plot re- hat as the current through the or is increased, the voltage drop this component first increases from zero to a peak (T2) and creases with further increase in finally falling to point T7.

the thermistor shows positive e from zero to T, but negative e from T, to T7. Points T1 to the curve represent temperature t those points resulting from heating in the thermistor due nt flow.

Thermal lag prevents the thermistor temperature from increasing instantaneously with initiation of current. A significant time interval thus elapses after applications of voltage before the current through the thermistor reaches the magnitude expected from an examination of the voltage-vs-resistance characteristic. Figure 3 illustrates this time delay characteristic.

The slopes of the curves shown in figures 1, 2, and 3 and the values of their co-ordinates will vary with thermistors of different types. However, the over-all configurations remain substantially the same.

HEATING METHOD

Each of the wide range of thermistor applications is based upon one of the characteristics illustrated by Figures 1, 2, and 3. These applications may be grouped further according to whether the thermistor is internally or externally heated (that is, whether by current flow or ambient temperature).

The temperature dependence of the thermistor resistance has been utilised for the stabilisation of circuit resistance in an environment of fluctuating temperature. Thus, thermistors have been employed to compensate indicating meters, fixed resistors, and balancing circuits; and, in the DC bias networks of transistor circuits, to stabilise operating points.

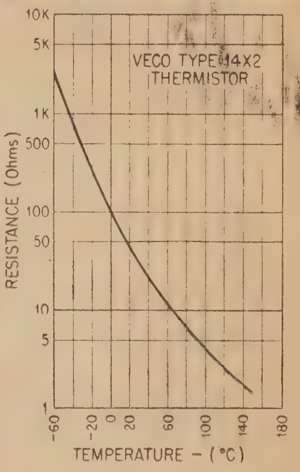
TYPICAL CIRCUITS

Figures 4 to 15 show representative thermistor circuits. These have been selected to illustrate the wide range of applications possible with thermally-sensitive resistors of this class.

Temperature Measurement. The thermistor is applicable as a temperature sensing element of good sensitvity. In this connection, a small thermistor may be mounted in the nose of an exploring probe. Figure 4 shows several circuits for temperature measurement.

In Fig. 4(A), the thermistor (T) is connected in series with a DC source, adjustable current-limiting resistor (R), and a direct current meter (M). Reference to Fig. 1 shows that, since the thermistor undergoes a large resistance change with temperature, meter M probably will be required to indicate amperes as well as milliamperes.

The meter may be set to zero, or to some other desired initial reading, by adjustment of R. As the temperature to



THERMISTOR TEMPERATURE-RESISTANCE CHARACTERISTIC

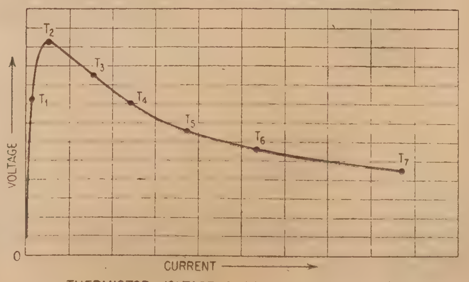
FIG 1

which the thermistor is exposed rises, the meter deflection will increase. The deflection may be referred to a current-vs-temperature chart, or the meter scale may be graduated directly in degrees.

In Fig. 4(B), a conventional DC ohmmeter is employed to indicate the thermistor resistance as it changes with temperature. The meter deflection may be referred to a resistance-vs-temperature calibration or the instrument scale may be graduated directly in degrees on the basis of such a calibration.

Fig. 4(C) shows one type of bridge circuit for checking temperature by measuring thermistor resistance. In this arrangement, the thermistor (T) forms one arm of the bridge, while the other three arms are conventional resistors.

One resistance arm, R2, is made variable for nulling meter M or setting it to some predetermined level at ambient



THERMISTOR VOLTAGE-CURRENT CHARACTERISTIC

FIG. 2

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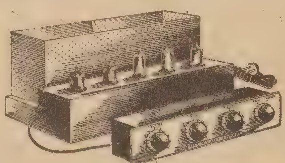

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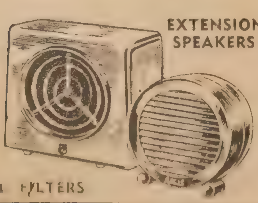

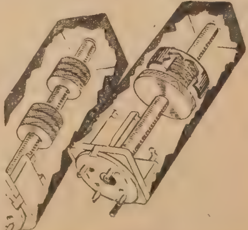

AEGIS
TYPE No.

ature or zero degrees. As the tor resistance alters in response perature, the bridge unbalances e meter is deflected.

bridge may be re-balanced and ermistor resistance measured in of the bridge arms (that is: R- /R2. Or the meter scale may be ted directly in degrees.

ddition to temperature measure- a number of thermistor circuits ilable for direct temperature con- g. 5 shows a simple arrangement the temperature-sensitive resis- f a thermistor in series with the a control relay.

g temperature lowers the ther- resistance, allowing the latter to ore current to the relay which lly is actuated. The supply volt- ay be either AC or DC, pro- the relay is chosen accordingly. greater sensitivity to small in temperature, a sensitive re- y be substituted for the indicat- ter in the bridge circuit in Fig.

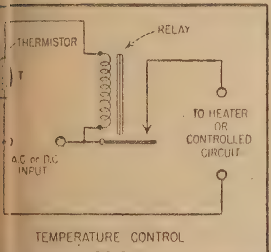
THERMISTOR
T
RELAY
TO HEATER OR CONTROLLED CIRCUIT
A.C or D.C INPUT
TEMPERATURE CONTROL

FIG. 5

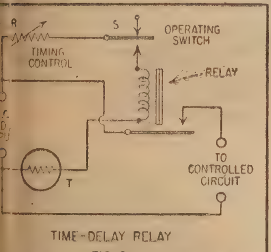
R
TIMING CONTROL
S
OPERATING SWITCH
RELAY
T
TO CONTROLLED CIRCUIT
TIME-DELAY RELAY

FIG. 6

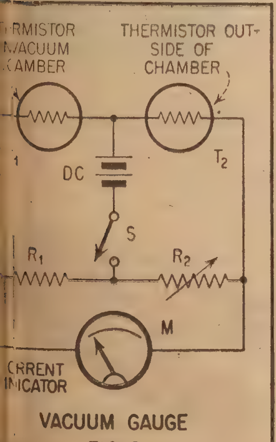
RMISTOR /VACUUM AMBER
THERMISTOR OUTSIDE OF CHAMBER
DC
T2
S
R1
R2
M
RRENT ICATOR
VACUUM GAUGE

FIG. 8

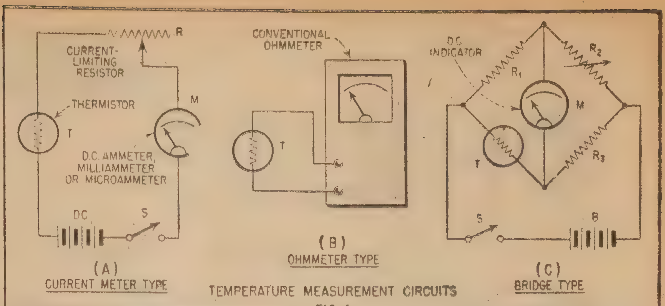
R
CURRENT-LIMITING RESISTOR
THERMISTOR
T
M
D.C. AMMETER, MILLIAMMETER OR MICROAMMETER
DC
S
(A)
CURRENT METER TYPE
CONVENTIONAL OHMMETER
T
(B)
OHMMETER TYPE
D.C. INDICATOR
R1
R2
M
T
R3
S
B
(C)
BRIDGE TYPE
TEMPERATURE MEASUREMENT CIRCUITS

FIG. 4

The thermistor delay characteristic illustrated by Fig. 3 may be utilised to obtain time delay effects in a simple manner.

In Fig. 6, for example, a thermistor is connected in series with an AC or DC source and a corresponding relay coil. Resistor R limits current and accordingly modifies the current-time curve of the thermistor.

When switch S is closed, the relay current gradually increases, according to the current-time curve of the thermistor-resistor combination. The current reaches a level sufficient to actuate the relay some time after closure of the switch. The length of the time interval may be selected by adjustment of R.

Within its power handling limitations, the thermistor may be employed as a voltage regulator, especially at low voltages, in the simple circuit of Fig. 7, to stabilise an output voltage against input voltage variations.

R1 is a current-limiting resistor similar to the same resistor in a gaseous-tube regulator circuit. The value of R2 must be chosen, with respect to the EI characteristic of the type of thermistor in use, for maximum regulating effect.

The voltage regulating action results from the fact that current through a thermistor, and therefore the resultant voltage drop across it, increases at a rate somewhat greater than linearly with applied voltage. A small change in output voltage (voltage drop across the thermistor) thus results from a rather large change in input (applied) voltage.

A particular desirable feature of this circuit is that it may be used to regulate either AC or DC.

For a vacuum gauge as in Fig. 8, thermistors T1 and T2 form two of the arms of a Wheatstone bridge. Thermistor T1 is placed inside the vacuum chamber, while T2 is mounted outside

Before evacuating the chamber, the bridge is balanced (meter M nulled) by adjustment of resistor R2.

As the evacuation then progresses, thermistor T2 can dissipate its heat due to current flow faster than can T1 inside the chamber because T1 is surrounded by progressively thinner air. Consequently, the resistance of the hotter T1 differs from that of T2, the bridge unbalances, and the meter deflects.

The meter scale may be calibrated to read chamber pressure.

Fig. 9 shows a flow meter operating on somewhat the same principle as the vacuum gauge just described.

Here again, there is a 4-arm bridge with thermistors in two of its arms. In this instance, one thermistor (T1) is mounted so as to be directly in the flow of a fluid (liquid or gas), while thermistor T2 is mounted in the fluid but outside of the flow.

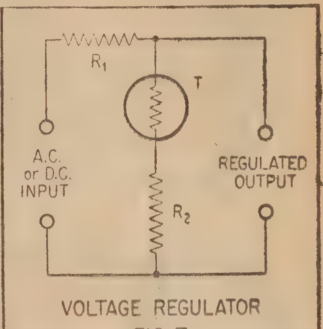
R1
T
A.C. or D.C. INPUT
REGULATED OUTPUT
R2
VOLTAGE REGULATOR

FIG 7

The bridge is balanced with the fluid quiet, by adjustment of R2.

As the flow progresses, T1 can dissipate its heat due to current flow rapidly because of the surrounding flow. But T2 becomes hot because of its quieter ambient. Consequently, the bridge unbalances, deflecting the meter which may be calibrated to read flow units.

A similar thermistor circuit has been used as an anemometer.

For a Sequence-Switching circuit as in Fig. 10, several load devices, repre-

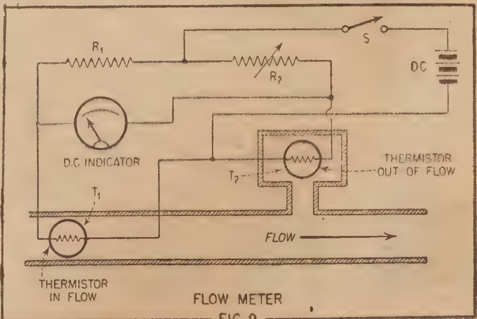
R1
R2
S
DC
D.C INDICATOR
T2
THERMISTOR OUT OF FLOW
T1
FLOW
THERMISTOR IN FLOW
FLOW METER

FIG. 9

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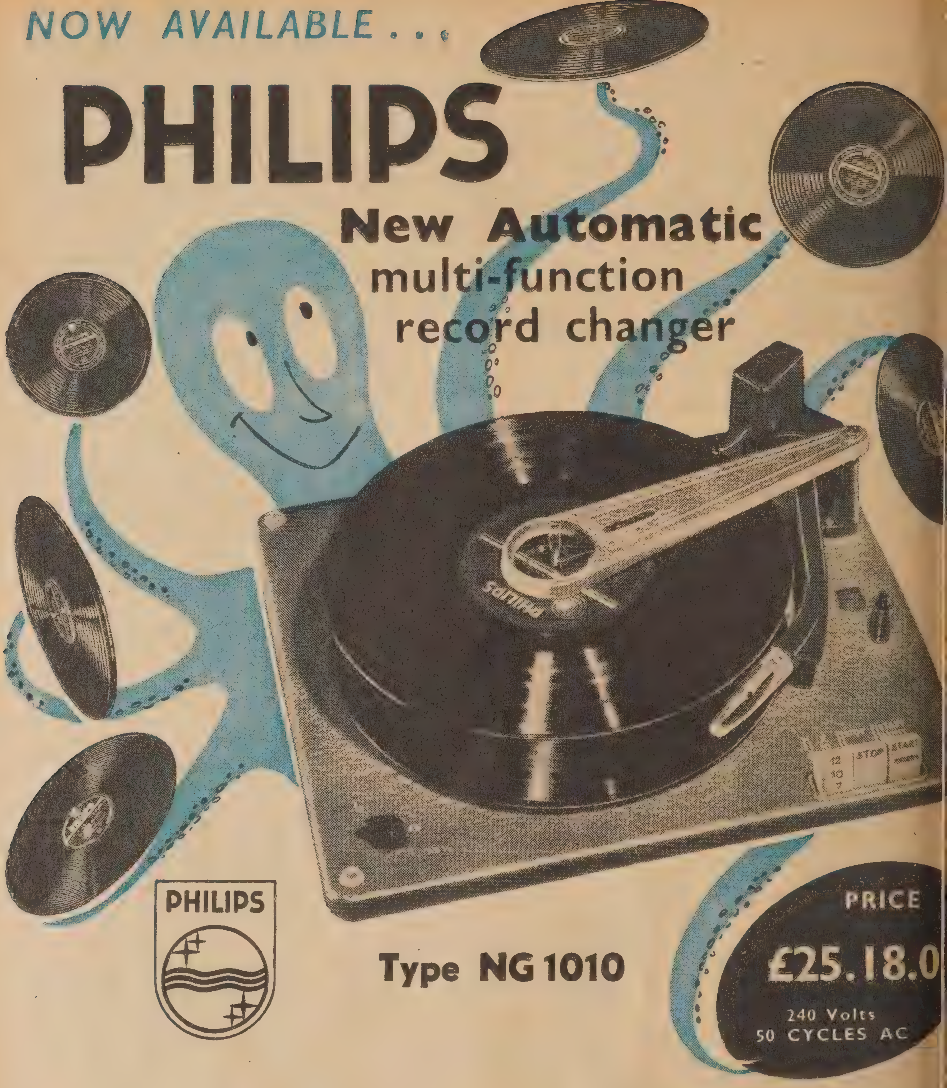

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- Plays 7", 10", 12" records of same speed interr
- Featherweight pick-up arm with detachable stylus, pick-up head — muting switch.
- All record speeds: 78, 45, 33 1-3, 16 2-3
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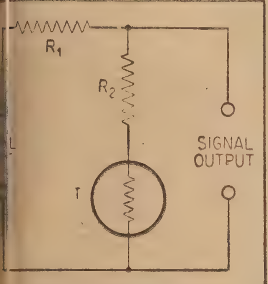
- No record damage.

PHILIPS ELECTRICAL INDUSTRIES PTY. LIMITE

Sydney • Melbourne • Brisbane • Adelaide • Perth • Hobar by RL1 to RLn are connected a line supplied by source E and ed by switch S. All except RL1 nected in series with thermistors Tn).

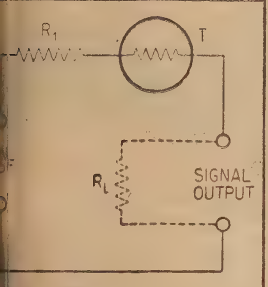
switch is closed, load device n operate almost instantaneously. ier load devices will be operated intervals, the time of each de- upon its resistance, since each ries with a thermistor which in- a time delay.

hoice of appropriate values of sistances (or of individual exter- ies resistances when each load has the same resistance) the de- ay be caused to operate in a sequence after the switch has osed.



IMITER (COMPRESSOR)

FIG.13



EXPANDER

FIG.14

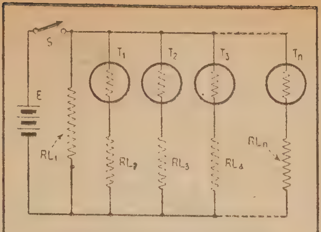
11 shows a Lockout Switching employing series thermistors.

is circuit, when any switch is d that leg of the circuit draws n through a thermistor. By prop- oportioning the series resistor Rn), the thermistor can be caused analogous to Thyratron action, conduct as long as its switch is d.

one leg is conducting, the cur- aw through the common series Rs, sets up a voltage drop Rs sufficient to reduce the line too low for any other thermistor e

esult of this action is that when of the circuit is in operation, r legs are locked out. The latter operate when their switches are d. Only when the switch in the ng leg is opened will the circuit red to the initial condition in ny other leg may conduct.

mplifier control, the thermistor e 12 is of the heater type. This ior has an internal heater element



AUTOMATIC SEQUENCE SWITCHING

FIG.10

which is connected across the output terminals of the amplifier. The thermally sensitive resistance element of the thermistor is connected across the amplifier input terminals where it forms a potentiometer with resistor Rs.

When the signal output rises, the thermistor is heated by this increased voltage across its heater, and its resistance decreases. By potentiometer action with Rs, the thermistor resistance then lowers the signal output voltage, and in turn the amplifier output.

The amplifier output thus is stabilised at a pre-determined level governed largely by the ratio of Rs to the thermistor resistance and is adjustable by means of Rs.

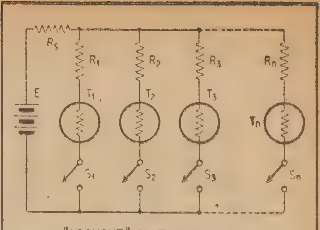
The simple limiter or compressor circuit in Figure 13 utilises thermistor nonlinearity in very much the same manner as the voltage regulator circuit (Figure 7) to obtain limiting action.

Because current through the thermistor increases rapidly while the applied voltage is increasing slowly, the resulting voltage drop across the thermistor (which constitutes the signal output voltage in this instance) is maintained constant while the amplitude of the signal input voltage fluctuates.

Choice of resistance R1 and R2 for a particular type of thermistor will yield efficient limiting action minus the high distortion encountered with simple limiters of some other types.

The opposite action is obtained with the circuit shown in Figure 14. Here, the output signal is the voltage drop due to the flow of nonlinear thermistor current through a series resistance (RL). A small increase in applied voltage (signal input) causes a large current to flow through RL, producing a large increment in signal output.

Amplification does not occur because the amplitude of the input signal is not increased by the circuit



"LOCKOUT" SWITCHING SYSTEM

FIG.11

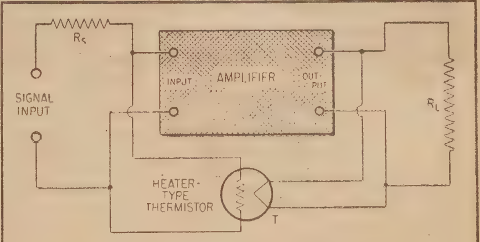
action, only its rate of change. In fact, the absolute amplitude is decreased by potentiometer action between R-, T, and RL.

The thermistor bridge shown in Figure 15 is invaluable for measuring AC power, since the low internal capacitance of the thermistor enables these measurements to be made anywhere in the frequency spectrum from low, power-line frequencies to microwaves.

The signal energy is applied to the thermistor only, through the isolating capacitor, C. The radio-frequency choke, RFC, prevents passage of this energy through the other arms of the bridge. The signal current heats the thermistor and thus changes its resistance proportionately.

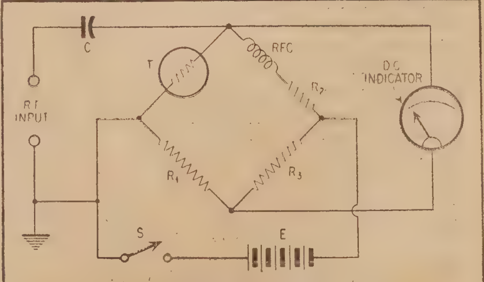
The thermistor resistance may be checked by adjustment of the bridge to null, whereupon $R = (R_1R_2)/R_3$, and this resistance value referred to a resistance-vs-power calibration curve to determine the signal watts. Or the scale of the indicating meter may be graduated directly in watts.

It is customary to employ a DC bridge supply, E, when measuring AC watts. When checking DC watts with a thermistor bridge, capacitor C is omitted from the circuit and an AC bridge supply and AC meter may be employed.



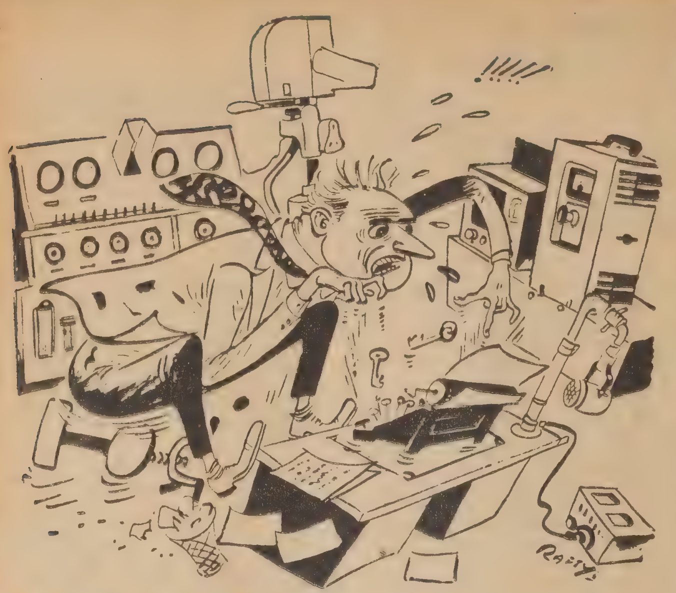
THERMISTOR FEEDBACK
FOR AMPLIFIER OVERLOAD CONTROL

FIG.12



U-H-F AND MICROWAVE WATTMETER

FIG.15



Let's Buy An Argument

As if it isn't enough to keep myself out of trouble, I am confronted this month by a coup
of letters objecting to a recent statement in the "Answer Tom" pages, where it was su
gested that image interference and double spotting were really one and the same thin

Okay, okay. I'll come quietly. You might have something this time.

Of course I could plead innocence on the grounds that someone else wrote the article in question.

I could even face the editor with a parody of one of the earliest sayings credited to homo sapiens . . . "The man thou gavest me . . . etc."

But all to no avail, I fear. Technical editors are supposed to check articles for their accuracy, and, faced with a possible dereliction in duty, can only stand trembling and abashed in the presence of the editor himself.

It's a fearful experience.

WHAT ABOUT IT?

Well, then what about this matter of image interference and double spotting?

Over and above more or less incidental references to the matter, I have to hand two letters, which I quote. One, from M.P., is short and sweet and is quoted in the panel opposite. I suggest you read it.

The other is sweet enough but not short and carries the signature of one R.F.S.

At first, I was tempted to make a precis of it and group the two together, setting about thereafter to explain the matter in some detail.

Then I had a better idea. Since R.F.S. had made a serious attempt to write an article correcting the original, why not have some diversion and instruction at his expense and examine his contribution also for expression and accuracy?

A kind of quid pro pro or whatever the phrase is!

In so doing, I'm not being in any way discriminating or unfair. Practically every original article that appears in the magazine is written by one member of our staff and vetted by another—at times very critically, to judge by the arguments that follow.

We set a good deal of store by procedure, however.

Coming fresh to a subject, the reader
may discover discontinuities and
crepancies in a line of reasoning,
seems perfectly straightforward t
writer, hence the arguments, as
said.

Well then, let's get to it, quotin
commenting as we go—and perhaps
ing ourselves open in turn for f
criticism! What's the odds?

THE LETTER BEGINS

Bypassing the niceties at the begi
of the letter, R.F.S. has this to say

"Dear Sir,

It would be true to say that i
interference and double spotting are
brothers but they are not the
person!

Image interference (also
second channel interference) is c
by having an unselective front-end
superhet receiver (either no RF sta
an unselective RF stage)."

COMMENT: Hold hard there!
author obviously has the right id
mind but it is quite incorrect to
that image interference is determin
the presence or absence or efficien
an RF stage.

The amount of selectivity requir
terms of bandwidth, is primarily r
to the intermediate frequency being
Whether or not this bandwidth c
achieved in one, two or more inpu
cuits is dependent, in turn, on the
quency range over which these c
have to tune.

If the intermediate frequency is
enough and the signal frequence
enough, the selectivity available f
single aerial coil may be sufficie
render image interference non-ob
Conversely a low intermediate freq
and high signal frequency may
in image troubles, notwithstandin
or even two RF stages.

A "WRONG STEER"

All this can't be said in the
ing paragraph of the article in que
but the reference to RF stages coul
be omitted, to avoid giving the rea
mental "wrong steer" right at the
set.

It would be much better to kee
first statement more general in cha
and also more accurate, simply m
the point that image interference
when the front-end circuits of a su
are not sufficiently selective.

Now to continue:

"In the case of a superheterody
ceiver with 455Kc IF transformers,
are two frequencies which can co
(one wanted and the other unw

by *Neville Williams*

s and
nning, w
ard to
s, as af

quoting
erhaps
for fur

ch can co
ther unw

t oscillator frequency plus 455Kc he other at oscillator frequency 455Kc."

MMENT: Nothing wrong with this ent. R.F.S. includes a small diahere to illustrate his point further, has not been reproduced, for the of brevity. Continuing:

our front end has to be unselecefore image interference can occur, ll stations which are transmitting nding their way down your aerial n—but you are only going to re those stations which produce a difference with your local oscilyour IF's being tuned only to pass c).

is being so, there are only two ing frequencies which can satisfy equirement, one being the desired n and the other the image, which ust eliminate."

ANATION LOOSE

MMENT: The writer's ideas are pparently in order, but his explanas so loose that it is really incorrect could certainly mislead an unind reader.

selectivity of a receiver has very bearing on how many signals find way down the aerial and lead-in. ermore, even if R.F.S. didn't quite this, it would be wrong to say that front-end selectivity allows ALL n signals to penetrate the signifisection of the receiver.

.S.'s explanation should suggest, , that insufficient front-end selecwill allow signals from within too a band of frequencies to reach IXER GRID, thus admitting into eceiver a signal capable of prog an image.

ere's one other point, less serious, hich I know is a potential source nfusion for beginners.

IF channel tuned to 455Kc does NLY receive signals at 455Kc. It ormally pass a band of frequencies d on 455Kc and up to about 20Kc It must do this in order to pass odulation sidebands belonging to M signal.

D OF FREQUENCIES

en referring to selectivity, pass-, etc., it is a good idea to forget vord "only" in its very restrictive and work in the idea of a band equencies or frequencies adjacent to ominal resonance.

far as the beginner is concerned, oice of the right expression, rather the wrong one, leaves the appropriference in his mind, even if it isn't oped. But as surely as you "teach" inner that a tuned system will pass one frequency, there will come a when he must be "un-teached" and ight idea substituted.

w on again with the letter:

ne means of helping overcome interference is to use an IF of r frequency but, unfortunately, this decreases the stage gain. Using Kc means that the desired station he image would be separated by 2 0 equals 3200Kc, which is a much separation than when using 455Kc gives only 2 x 455Kc equals c.

is obvious that if one station is ated from the other by 3200Kc in of 910Kc, the image ratio is going to be much greater and this will give the RF stage or stages a better chance of discriminating between the two. As a result of this, the 3200Kc image should be almost non-existent.

IMAGE INTERFERENCE OR DOUBLE SPOTS?

Dear Sir,—

I am afraid I don't agree with the statement on page 55 of the January edition, which says that double spotting is just another name for image interference. According to our notes, which are adapted from the Melbourne Technical College notes by the R.A.A.F. they are totally different.

The particular case described in the article is listed in our notes as double spotting and image interference is an effect when two different signals beat with the one oscillator frequency.

For instance, if the oscillator is set to 7,455 Kc/s to beat with a 7,000 Kc/s signal, it will also beat with a signal at 7,910 which will also give a 455 Kc/s beat. The undesired signal is called the image.

In short, double spotting is the effect of one signal beating with two different oscillator frequencies while image interference is an effect between two different signals beating with the one oscillator frequency.

With image interference you have two different stations on the one setting of the dial, while in double spotting you have the same station on two different settings.

Yours Sincerely, M.P.

"We then deduce from the preceding that any superheterodyne receiver with an unselective front end will suffer from image interference. It just can't help it."

COMMENT: The figures are right but the whole force of the argument rests on the comparative selectivity of the signal frequency tuned circuits. It highlights the weakness of earlier references to aerial and lead-in, to "all" stations coming in, etc.

RF STAGES AGAIN!

And, again, we have that unfortunate reference to RF stages, presumably, as an essential feature and a measure of front-end selectivity and image response. The writer completely ignores the fact that an overwhelming proportion of broadcast receivers use a 455Kc IF channel, have no RF stage, rely on a single aerial coil for front-end selectivity—and produce very little embarrassment due to image reception.

So we continue:

"The effect of this image fault is that it produces two stations on the one spot on the dial (when each is as stated 455Kc on either side of the oscillator frequency) and it is difficult, if not impossible, to know whether two stations are transmitting on the same frequency or not, as image interference makes it appear as though they are both on identical frequencies.

"On the short waves (or for the strange modern we now seem to have with us who is not accustomed to thinking ambidextrously but seems to think that wireless only started the day he became interested in it)—high frequencies—image interference shows up at times in a most peculiar manner.

"You may be listening over a period to a desired station and due to changing ionospheric conditions, the frequency corresponding to the image may start coming in (at a later time) causing both confusion and annoyance.

"So much for image interference."

NOT WELL WRITTEN

COMMENT: The first paragraph is okay but the second would suffer drastically from the Editorial blue pencil. Little quips and personal biases may be admissible and even desirable in certain types of article but NOT cut right into the middle of a sentence forming part of a serious technical explanation.

By the time the reader has worked out what all the extra words mean, he may well have lost the original train of thought.

But, in any case, the original train of thought has suffered a sudden and strange malformation.

Surely, the vital point about "shortwave" reception is the relative proximity of the real and image signal in terms of signal frequency and the consequent difficulty of selecting one and rejecting the other. This is where emphasis could have been laid very appropriately on the matter of RF stages.

But the vital points are not made. Instead the reader is introduced to an interesting but much less important occurrence, when signal fading is evident.

Now comes the second part of the letter:

SECOND PORTION

"DOUBLE SPOTTING. As stated, it is related to image interference but is a little different.

"Double spotting is where the same station (transmitting one, only one frequency) can be picked up twice, that is at two different spots on the dial. To receive double spotting you must tune your receiver (oscillator) to the spot twice the intermediate frequency away—that is to a position 455Kc to the other side of the desired station.

COMMENT: Here another drawing follows about which we have some reservation. However, the idea is clear enough in the writer's find. If, for example, the oscillator is normally 455Kc higher than the desired station, then a double spot may be evident if the receiver is tuned to a frequency 455Kc lower than the station's frequency. To continue the quote:

"Double spotting was more prevalent on the broadcast band when 175Kc IF's were common (say about 1928) but today it is not known on the broadcast band with 455Kc IF's (because 2 x 455Kc drops it outside this band)."

COMMENT: This paragraph contains an actual error and also puzzles me somewhat. Why is there no reference to the RF stages that seemed earlier to dominate his thinking? Does he imagine

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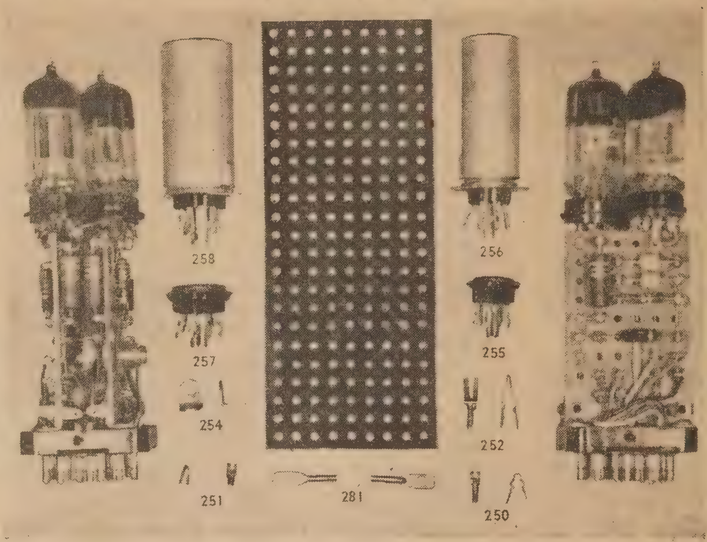

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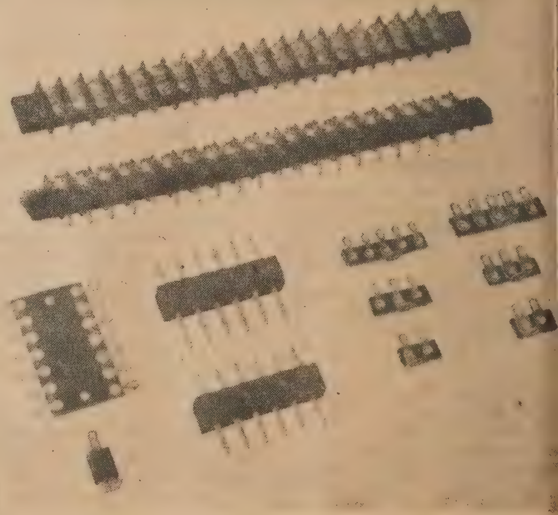

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ly infer by the omission that an RF
is important in one case and not
ther?

ch imaginings or such an inference
d be very difficult to justify.
t first the error. A modern broad-
receiver tunes over a range of at
550 to 1600Kc, so that its oscil-
operating normally on the high
of the signal frequency, tunes
ltaneously from 1005 to 2055Kc.
itions within the range 1460 to
Kc have a potential double spot
ion between 550 and 690Kc. It is
ly due to the efficacy of a single
l coil that the average receiver is not
ied by such trouble.
id still referring to the broadcast
, it is precisely this same aerial coil
n prevents stations from the range
to 1600Kc appearing as images on
ns 550 to 690Kc. The phenomena
s close as that! Back to R.F.S.

)RT WAVES

)ouble spotting still can occur on
short waves where the front end
nselective (incorrectly tuned or low
This is one of the difficulties en-
tered with home-made receivers
e alignment has been slipshod or not
l.

is rarely found in good brand com-
ication receivers as the designer has
dy been through all this with his
otype but unfortunately, with the ex-
nenter, everything he builds is pro-
e and so he is never completely
from headaches. How little the
who buys a completed set over the
ter knows of this—but the experi-
er gains knowledge."

)MMENT: Double spotting does oc-
on the short waves, to be sure but
est of the paragraph just about qua-
for the W.P.B. (waste paper bas-
There is little to choose between
parable home-built and commercial
vers in the matter of double-spotting
mage interference. Some sets are
ed better than others and some
l coils may be better than others
no simple short-wave superhet, to
knowledge is free from the trouble,
aligned accurately or not.
n RF stage helps, but only to a de-
. The image or second spot will be
weaker but still present.

CTS ARE FACTS

or does it help to engineer any num-
of prototypes. Once the potential
particular circuit system has been
oited, no amount of fiddling will
g about any drastic improvement.

nd "communication" receivers? The
ition contains no magic of its own.
communication receiver only has
RF stage and a 455Kc IF channel,
it will suffer from the effects in
tion, notwithstanding the fondest
es of its designer. If it has two RF
es, it will be better, but still far
n perfect.

ow we read on:

The conclusions we thus draw are—a
iver with an unselective front end
automatically suffer from image in-
rence and if it suffers I.I. then the
e station can be tuned in at two
s on the dial and this is called double
ting."

OMMENT: Wow! If R.F.S. isn't
ful, he'll be agreeing with our "An-
Tom" writer and then he'll start an argument with himself. But why make double-spotting dependent on image interference?

The whole point of the matter is this: The IF resultant in a superhet receiver may be produced whenever the requisite difference frequency occurs between an incoming signal and the local oscillator, irrespective of their relative positions. This is a potential source of confusion and the designer has to rely on one or more circuits tuned to the signal frequency to eliminate (if possible) the unwanted combinations and resultants.

IF INADEQUATE . . .

If the front-end selectivity is not equal to the task, then spurious and confusing signal responses occur, either due to two signals beating simultaneously with the one oscillator frequency or two oscillator frequencies—at different dial settings—beating with the one signal.

The cause is the same and the effects normally occur in association. If desired, the first can be singled out and described as image response, the second as double spotting.

And there, I think, we can leave the matter rest. R.F.S. has made his point successfully and can retire with honour vindicated. But had R.F.S.'s letter been submitted as a technical article, it would have gone back to him duly decorated with blue pencil marks for the reasons listed.

He would have retired with honour vindicated, to be sure, but also with the Editor's words ringing in his ears: "Better have another go at it, old Bhoy!"

It's happened before you know.

Good heavens. It might happen again!

By way of a change, we reproduce in the panel above a couple of letters, or rather extracts from same, which express readers' views, without the need for any lengthy comment from Yours Truly. In fact, I'm not in a very good position to comment.

In an earlier letter, which was reproduced on these pages, D.F. extolled the virtues of the divided load type amplifier. We published it, wondering whether anybody had any strong feelings on the matter—but to no effect. Not a single extra line, to my knowledge was written, either for or against the idea.

In a way this is understandable, because not too many readers would be in a position to say "I have measured and compared results and find that these

(Continued on Page 121)

SYNCHRODYNE, HI-FI AMPLIFIERS

Dear Sir,—

It was with great surprise, and perhaps a little vanity, that I read this month's issue, with my letter so prominently published re Divided Load amplifiers.

Your non-comment on the subject makes me a little apprehensive of your opinion, but I still think it is more Ultra than ever Ultra was.

My present suggestion is a version of the Synchrodyne receiver. To my knowledge such a set has never been exploited in your magazine. This type of set has disadvantages like any other set, but I think its advantages far outweigh these, certainly much more so than the TRF, which is in December issue.

Push button tuning is the suggested remedy for the heterodyning which occurs with the conventional tuning, but I am inclined towards a system of counter A.G.C., which, until the carrier is brought to a pre-set level, the signal and heterodyne are blocked or diverted.

I know what you're thinking (easily said), but I think it can be done. Either way it's a set which is new and interesting, along with being a really top grade performer.

Sincerely, D.F.

Dear Sir,—

Having visited various trade houses in N.S.W., S.A., and Victoria, I am of the opinion that many (in fact, most) of these are creating false ideas about, and doing harm to, Hi-Fi popularity.

In demonstrating such equipment they make such serious technical errors that they render it almost impossible for a customer to form an opinion of the relative merits of gear available. A bit of publicity by R.T. and H. could help correct this.

Here are some examples:—

1. Using the same load resistance on each of several pickups when demonstrating each successively, instead of using the recommended load.

2. Having gone to a lot of expense in setting up gear, demonstrating it in rooms quite unsuited to the purpose.

3. Demonstrating speakers in enclosures, etc., quite unsuited to such speakers. A glaring case is one I saw recently.

These people had set up a Goodman's 3-way speaker setup, but had used about 3/8in plywood for the front panel of the bass enclosure, which had the Acoustical Resistance unit mounted in it.

The demonstrator said, "This beats the Wharfedale 15in — see where we've plugged up the hole where it was!!!" Not that I am plugging for Goodman's or Wharfedale, but how can they compare the two speakers when the cone resonance is so different and the Wharfedale is not intended to work into the Goodman's enclosure—(of 3/8in plywood!!).

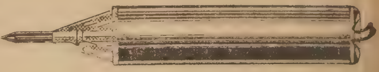
Incidentally, this demonstrator turned the treble down 3 or 4 notches and bumped up the bass. This really did things to the enclosure. "Sounds good, doesn't it?" he said.

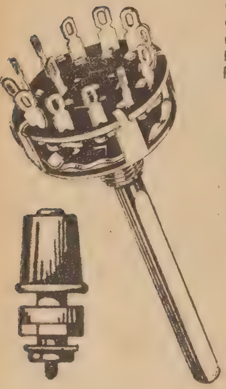
I hope you will assist in the campaign for true values in the Hi-Fi game.

Yours faithfully, H.A.P.

JABEL

Fine RADIO COMPONENTS

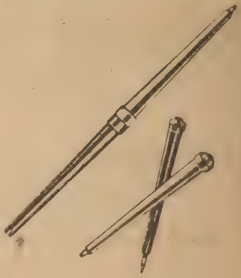




Rotary Wafer Switch. A single bank unit of compact design. Diameter only 1¼" (size of a penny), depth ⅞". Single pole type, up to 12 positions; two pole up to 6 positions; three pole to 2 and 3 positions; and four pole to 2 and 3 positions.

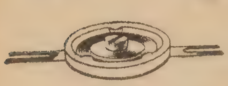
Probe Housing. Chrome-plated brass tube with clear polystyrene mouldings. Internal size, 7/8" x 4".

Insulated Spring Terminal. Fully insulated from chassis, nickel-plated brass post, moulded polystyrene body. Made in six brilliant colours—red, black, light and dark blue, green and yellow.

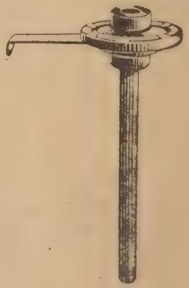


Aligning Tool. A dual-purpose tool with screwdriver tip for standard I.F. transformers. Reverse end has recessed slot. Nickel-plated brass fittings moulded into polystyrene.

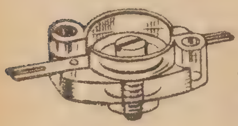
Test Prods. In red and black polystyrene, plated brass tips, ample lead space.



Junior Trimming Condenser. Non-hydroscopic moulded base, silver-plated phosphor bronze plate. Fine thread, giving smooth linear variation from 4 to 60 mmfd. The diameter of sixpence, and ⅛" thick—ideal for gang mounting.

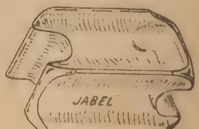


Planetary Vernier Drive. 5 to 1 reduction (No. 1 illustrated). No. 2 has cursor mounting flange. Instrument log dial scale assembly also available

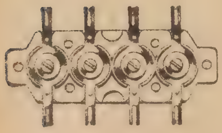


A chassis **Standard Trimming Condenser,** mounting type in high impact polystyrene. Similar characteristics to Junior model.

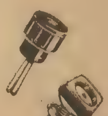
Padding Condenser 35-270 pf and 180-780 pf (455 kc).



Egg Insulator. Polystyrene moulding—the lightest, strongest and best insulator procurable. Absolutely unbreakable.

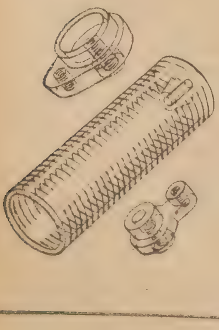


Trimming Condenser Blocks. The Standard Trimmer is also available in blocks of four (illustrated on left), three and two units.



Miniature Banana Plug, N.P. brass split pin for positive contact. Solderless screwed type connection.

Socket. Insulated collar recessed for protection from "hot" circuit. Stepped for insulation from panel. Both available in red, black, green and yellow



Moulded Polystyrene Coil Former and Coil Mount Bases. ¾" diameter formers, 2" long, grooved to 16 T.P.I. (or plain), one end open, other tapped 5/32" for mounting or core. Larger coil base fits either ¾" or ½" formers and is tapped for core and mounting. Small unit is for 3/8" formers, also tapped as above.

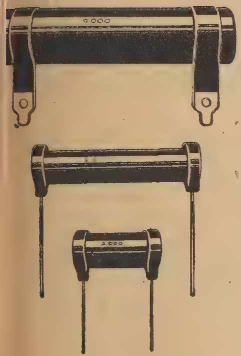
FROM RADIO STORES EVERYWHERE

Sole distributors Watkin Wynne Pty. Ltd., North Sydney. Represented in all States

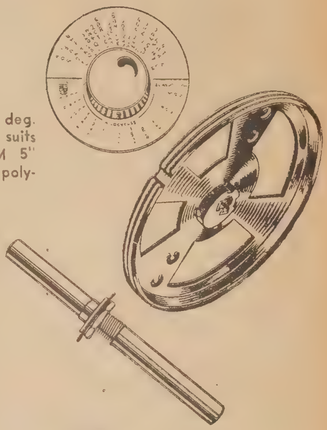
Fine RADIO COMPONENTS

JABEL

FINE RADIO COMPONENTS

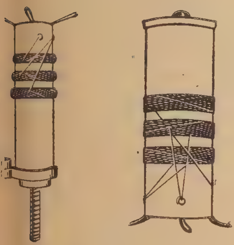


Wire Wound Resistors. 3, 5, 8 and 10 watt, preferred values 5% tolerance, A coat Coat B and C to order.

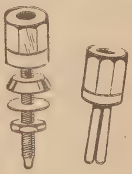


Knob-Dial. Calibrated perspex 180 deg. with stations and Kilocycles. $\frac{1}{4}$" bore; suits direct drive Roblan gangs. DIAL DRUM 5" double track, moulded high impact polystyrene, $\frac{3}{8}$" bore, 2 grub screws.

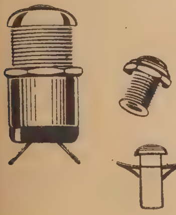
Extension Shafts. 1/4" to 1/4", 1/4" to 3/8", 3/8" to 3/8". Nickel plated with steel grub screws. COUPLINGS 1/4" to 1/4", 1/4" to 3/8" in plated metal; 1/4" to 1/4" insulated. **Expanding Bushes.** 1/4" to 3/8", also 3/16" to 1/4" split brass.

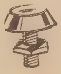


Crystal Set Coil. Three pye, litz wound coil with tappings, mounting base and screw, circuit. REINARTZ type tuning coil, litz wound, iron core and mounting base, circuit.

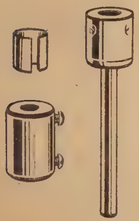


Instrument Terminal With Banana Socket. Red or Black moulded bakelite—takes standard banana plug within captive head. BANANA PLUGS to suit above, also insulated panel BANANA SOCKETS.

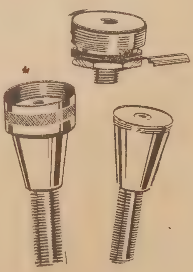




Bezels. Chrome plated panel mounting, $\frac{5}{8}$" diameter complete with lampholder, in Red, Green, Amber. Also available in $\frac{3}{4}$" diameter, and bezels only without lampholders, in both sizes. PANEL BEZELS $\frac{3}{8}$" diameter in Red and Green PANEL LENS $\frac{3}{8}$" face, $\frac{1}{4}$" shank translucent plastic with fixing washer, Red, Green, Blue, Amber, Clear.



Dial Spindle Assembly. 1/4" shaft on 3/8" bush, complete with nut and lockwasher. DIAL SPINDLE PANEL BUSH available separately.



Coaxial Connectors. Single contact pressure type, plated finish. Female cable, male cable and male panel fittings.

Discriminating radio engineers, manufacturers and custom-design specialists choose JABEL Fine Radio Components because of their reputation for consistent high quality and reliability which results from many years of accumulated technical experience.

OFF THE RECORD — NEWS & REVIEWS

Articles and comments recently published in our magazine about stereo records have certainl stirred up keen interest. They have also confused many people who are making plans fo record-playing equipment. Naturally they do not want to spend good money for items whic later they must discard.

IN general, I do not think stereo records will mean casting aside any good equipment you now use, or are thinking about. Naturally, a new pickup head will be needed also a second amplifier and loudspeaker, both of which will supplement the one you have. As long as your turntable is a good one and free from rumble, there seems no reason why you need buy another.

But if you are in the market for a motor, get the best you can afford.

What will be needed—not always forthcoming in an ideal form in the average home—is a good arrangement for the loudspeakers.

It will be necessary to space these several feet apart and to have available a listening position about the same distance from each.

In practice, this may mean placing the speakers against a wall furthest from your normal chair position which is probably near the fireplace if any.

ROOM CHARACTERISTICS

Oddly shaped and highly reverberant rooms are not likely to allow the stereo effect to show up as it should.

Some people appear to have the idea that stereo is by nature part and parcel of hi-fi, by which they imply the highest quality—and cost—equipment.

I don't agree with this at all.

What stereo will give is an extra dimension to sound which so far has been missing, and it will do this whether the original sound is hi-fi or not.

It's understandable. I suppose that anyone used to handling very good equipment can't imagine listening with profit to anything else.

Whereas you and I know that we can enjoy quite modest gear if it is free from obvious and gross sonic malformation which can always be avoided if the owner doesn't try to achieve the impossible.

With stereo, the extra dimension will undoubtedly divert our ears from limited frequency range, and lower output, for, as I have already pointed out, these things will be entirely reassessed with the new records.

VALUABLE ADDITION

In other words, stereo will be a valuable addition to all our present standards, hi-fi or low-fi, both of which terms may suffer considerable modification in the process.

I can foresee that the most popular stereo set-up will be far from elaborate.

It could well consist of a better-than-present-average motor fitted with a crystal pickup from which two outputs are led away. These will feed a twin amplifier with built-in compensation and a minimum of tone controls, if any. Single-ended outputs could be used with no more than about 4 watts apiece, and a common power supply to feed the lot. Two good commercial-quality speakers, possibly 10-inch types, housed in small cabinets of the RJ or back-loaded type would make up the system.

It should not be long before reliable information is available from manufacturers, setting out the standards for the records themselves, and from pickup designers outlining their plans. Even before these details are to hand, we should be able to build up some preliminary amplifiers on these lines, and even use them for a while on a frequency selective basis similar to my old stereoscopic system of about 20 years ago, which I note has been revived somewhat overseas.

Just play the bottom end through one channel and the middle and top end through the other.

Not stereo, but it sounds very good. By using it on your single-track records, you could get somewhere near the real thing at all times. Sounds attractive? I think it does.

Strangely enough, I think the major problems might be in handling a really hi-fi stereo system.

Unless the room is quite large, and carefully controlled, multiple speaker set-ups, for instance, could cause some curious effects.

But if you are able to command really good conditions, some fascinating times are ahead.

Like taking a split from each channel and feeding the resultant into a third speaker system spaced midway between the two.

"If this hurts, it's because I need some blood-curdling screams for our Amateur Dramatic Society."
—Record Review

It's going to be interesting to how successfully we can deal with "hole in the middle."

Before long I think we are likel be reading some very learned ar on room acoustics.

They will without doubt be a factor in helping us to get the there is.

RECORD REVIEWS

BRAHMS - Hungarian Dances 1 in G minor, No 5 in G min No 6 in D major and No 10 F major. Played by the Sinfonia London conducted by Richard A tin. World Record Club TT1.

DUKAS - Sorcerer's Apprenti DEBUSSY - Afternoon of a Fa MOUSSORGSKY - Night on Bald Mountain. BORODIN - P ovtsian Dances. Played by Florence May-Festival Orchest conducted by Vittorio Gui. Wo Record Club T7.

The World Record Club, now ating in Australia, is joined by p a 5/ registration fee, upon whic list of records to be issued fo next 12 months is sent out. The ber nominates which of these h prepared to buy, and when ready are sent to him on a money-ba not-satisfied basis. If he doesn't any of the proposed records, he ne buy them.

But if he does, they cost only plus postage for 12in LP's, 27/6 10in, and 9/6 for 7in EP's.

Which is a very attractive figure.

The sceptic will ask—at that are they any good?

Well the names of orchestras and formers are mostly unfamiliar w isn't to say that they are not of quality.

Some of the orchestras are mad of players from world-famous com tions, and some are probably orchestras themselves under diff names.

GOOD STANDARD

The EP of Hungarian Dances, is sent free to each registering me is a good sample of the standard I so far observed, and there is no second rate about it.

Technically it doesn't enter the top flight, but then very few re do. Definition suffers a little thr exuberance, and there is a diffe in quality between No 1—which is ticularly good—and the remaining

Otherwise it is bright and attra clean and well defined in the top reg and with low surface noise.

The 12in LP seems a very good Best of the items I thought wa Debussy, which can stand compa with just about any other version.

Apprentice isn't as analyti- e score suggests it might be, the essential excitement and ia is well shaped. The Pol- Dances could have been a little but many people play them this

ound is again bright and clear. surface good.

* * *

ZART PIANO WORKS 10—Sonata in C major K330; in C major K309; Rondo major K485; Eight Variations major K352; Capriccio in C K395. Played by Walter ing. Columbia 330CX 1428.

isn't a great deal to be out this record which has not been said about the earlier

ing plays with a small, light tone, crystal clear in its enun- and beautifully controlled out.

ves the sonatas a limpid quality always delightful and always g. and in most of the material corded it comes off very well y his tempo is brisk, and he ttle tendency to linger when the on offers

frankly this is a good thing, more successful than in the of the K309.

yet equally welcome would have little more brightness, for in- n the Rondo of the same sonata.

nere is far too much music here hrough it in detail, nor would ally be much profit in doing so. all so consistent and balanced ormance as to resist such treat-

d it as well as any of the nine hich have gone before, and des- ew reservations most people seem about Gieseking's Mozart, that praise

piano recording is good, and the noiseless

* * *

ZART—Bassoon Concerto in at major K191; Six Prague ian Dances K509; Two Mar- K335. Played by Rudolf Klepac oon) and the Salzburg Mozar- Orchestra conducted by Ernst endorfer DGG LPM 18297.

as a feature of Mozart's versa- nat he could write fluently and fully in almost any musical form. even the prospect of a bassoon o did not cause him any embar- nt

only that, but despite the difficulty task he produced a most tuneful f work

contribution to orchestral colours by the bassoon is valuable and but it is a tribute to all con- that at no time does it sound us in this concerto.

or twice it gives out with some ad tones, and an odd excursion e lower registers could be likened unreligious as a distant relation spherry

when you get through your task and almost inevitable smile, you alise that the bassoon isn't neces- an odd or awkward instrument, the fairly close miking it was impossible to avoid.

ac plays with a full and rather s tone, making the most of his ous part and handling technicali- h ease

The German Dances and Marches on the other side are extremely well played —obviously the orchestra doesn't carry the name of Mozart for nothing.

To a completely satisfying musical standard you can add an equally satisfying recording, smooth and easy to play relaxed and sure in its approach.

Good value for its content and its execution.

* * *

THE INK SPOTS—Twelve Popular Numbers sung by themselves. Tops L1561

There have been changes in the Ink Spots combination since their palmy days about some 15 years ago, and to be quite honest none of the changes has improved upon or equalled the original team.

Particularly the bass, whose inimitable monologues in those early records were classics.

However, to some extent the better recording of the present company makes up for the difference, although the leader has a huskiness to him which wasn't there when we were all younger.

You will meet again many favourites such as "Into Each Life," "Whispering Grass," and "Making Believe." But what happened to "Address Unknown" and "It's Funny to Everyone But Me?"

The Ink Spots still command a big following, and if you are part of it, this is for you.

The recording is very good.

Incidentally this is a new label of popular music, distributed in Australia by Philips.

* * *

ADVENTURES IN SOUND—Preludes to Acts 1 and 3 (Traviata); Intermezzo (Cavalleria Rusticana); Overture (Cleopatra); Sicilian Vespers Overture; Notturno in G flat (Martucci); Dance of the Hours (Ponchielli) Played by the London Symphony Orchestra conducted by Pierino Gamba. Decca LXT 5325

Decca's latest sound technique is very different from that of the early days, when pre-occupation with the higher register produced some awkward moments particularly on hi-fi gear.

Today the accent is on balance.

This balance combines every feature in modern recording, frequency response volume contrasts, the instruments themselves, all combined with a sense of immediacy which is unmistakable.

You'd need to be tone deaf to miss it.

It is very difficult to criticise sound of this order. But I would emphasise that there is nothing exhibitionist about it. This isn't a disc to stun your visitors in showers of brilliant percussion or deafen them with decibels.

Every item is an example of music, superlatively played and superlatively recorded.

It's true that by the time you have played it out, Decca will have demonstrated pretty well the whole range of orchestral resource.

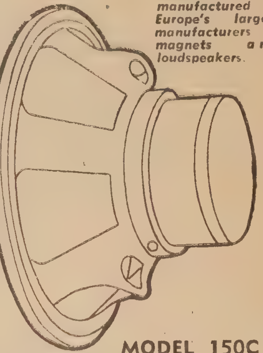
And although you will hear amazingly fine massed strings, subtle metallic noises strongly bowed basses, and deep strings which for all their quiet accompaniment somehow vibrate your floor-boards, and so on and so on, the true accomplishment is in the cohesion and realism with which they have been blended.

If you listen into the music of Traviata, for instance, or the Dance of the Hours, you will literally discover things you haven't heard before.

This clarity can only be obtained by

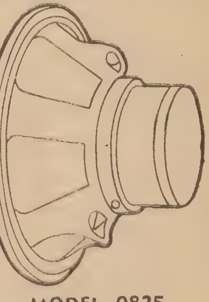
THE NEW PEERLESS MATCHED TRIO

Designed and manufactured by Europe's largest manufacturers of magnets and loudspeakers.



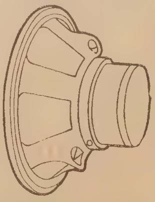
MODEL 150C

Fifteen inch low frequency unit
Resonant frequency: 40 Cycles
Total Gap Flux: 240,000 Maxwells
Voice Coil: 2" Diameter
Magnet Weight 6 lbs



MODEL 0825

Eight inch mid range unit
Total Gap Flux: 54,000 Maxwells
Voice Coil: 1" Diameter
Smooth Response throughout the entire mid frequency range



MODEL GT HF

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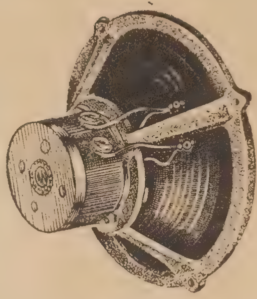

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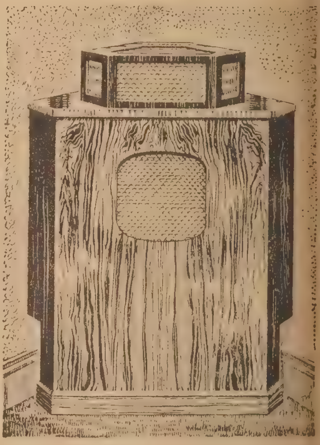

Sand-filled Corner Enclosure as recommended by Messrs. Wharfedale.

Illustration shows unit in use with middle and high frequency speakers facing upwards. (N.B. This unit also recommended as the ultimate for the Super 12" FS/AL speaker and twin speaker systems.)

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ery greatest care in mike placement, beration control, the fixing of pre-, the control of distortion, particu- intermodulation, right through to inished cut, and the reduction of ground noises to zero.

ere's some mighty fine engineering on with discs at the moment. is Decca's way of showing you it can do, and it will take some ng.

★ ★ ★

HANDEL - The Messiah. Adele dison, David Lloyd, Russell erlin and William Warfield with New York Philharmonic Orches- and Westminster Choir conduct- by Leonard Bernstein. Coronet C 626/7.

rnstein has already achieved not- success in his explanations of jazz Beethoven to the unconverted. He rmed both tasks with imagination with an admirable knowledge of ubject matter.

viously he has viewed the Messiah eat music in which tradition is in er of obscuring the greatness.

this version he has done two things. he has rearranged the 41 sections two halves—a Christmas half and aster half. Frankly I don't think this ry important, as few listeners hear ork in a continuous manner.

ondly he has insisted that all con- d sing it with vigour and aware- —he has tried to bring it down to from a somewhat distant pedestal. has succeeded in this, but in do- o he has lost an air of grandeur I think is important to hold it her. His close proximity has thrown emphasis on individual perform-.

the soloists, Warfield is easily the He has warmth and dignity and standing which if not remarkable nost commendable. Lloyd, the ten- quite well cast, but with a vibrato sometimes interferes with pitch ration.

e others support well, and each high spots.

e orchestra is extremely good, but hoir has varied success. Technically our sides are high class.

compared with previous versions, one classes itself. It is good to hear vigour in choruses such as Unto Child is Born, and it compensates the other passages not so success-.

must stress that this is an import- and a sincere recording, not to be cted merely because it is different. e final account of profit and loss ds no apologies. In the illuminating t notes, Bernstein himself makes case, and in the recording itself as amply justified it.

s a stimulating and often inspiring of work.

★ ★ ★

BEETHOVEN — Concerto for ano and Orchestra No. 1 in C ajor, Opus 15. Played by Wilhelm mpff and the Berlin Philharmonic chestra, conducted by Paul van empen. DGG 18129 LPM.

mpff is a man whose contribution ecording is best considered as a e. He has now produced so many discs, particularly of Beethoven, h, like those of Backhaus or of eking, can be collected for thier own s as well as for their own worth.

This version of the Beethoven No. 1 Concerto is a case in point.

You cannot hear it without being aware of the man's own brand of musicianship, personality, and his long devotion to his craft.

Whether you always agree with what is being done isn't particularly significant. With a musician of his experience and maturity, everything is of importance and worth respect.

I have heard this work played dozens of times, and most of them have impressed me as being little more than playthroughs.

It is an early work, and has enough in it of Beethoven's predecessors to sound very like them in parts, if played that way.

With Kempff, only Beethoven could have written it.

He brings the first movement to life in a dozen different ways of illuminating a phrase, or turning a corner.

He plays the second movement quite slowly, much more so than is normal, and as I am fond of pointing out, that is very, very difficult with Beethoven.

But once again, he is not to be caught out; his phrasing, sense of musical shape, and his trick of making one anticipate every note to come sustain the music and justify his view of it.

The sound is satisfying, although it has a characteristic often heard with DGG which endows a slightly tubby effect to the bass.

It is the best version of the concerto I have heard to date.

★ ★ ★

BEETHOVEN—Violin Concerto in D major Opus 61. Romance No. 1 in G Opus 40; Romance No. 2 in F Opus 50. Played by Bronislaw Gimpel and the Bamberg Symphony Orchestra conducted by Heinrich Hollreiser Vox APL 9340.

This isn't a "big" version of the Beethoven, but it is a very beautiful one.

Gimpel has emphasised its lyrical qualities, and rarely strives to find anything heroic in the music.

We are given a hint of this in the jacket notes, which labels the concerto as "sweet."

Not only will most people find this an inadequate and misplaced epithet, but Gimpel himself obviously has rather more extensive ideas about it.

So please don't be put off by such an assessment, for if you do you will be the poorer by an extremely good version.

If Gimpel is new to you, as in effect he is to me, let me say that he is a most musicianly player. His tone is on the fine side, but sensitive; his intonation is rock steady and his lyricism has sincerity which never degenerates.

He is a fine technician, too, despite a tendency to rush odd phrases which, particularly in this concerto, would have been more effective with greater steadiness.

But this is splitting straws—if we leave out the one or two heavyweights in the field, no one has surpassed his work.

The orchestra, in its performance and its recording, is of the same general character.

It doesn't compare in size with some others, nor does it sound as forward, but is very clean and has a nice frequency balance.

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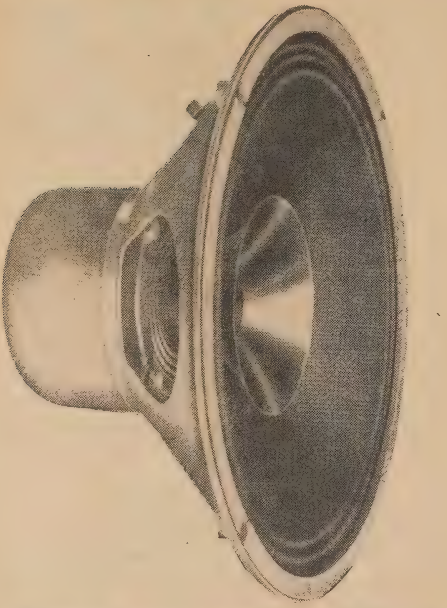

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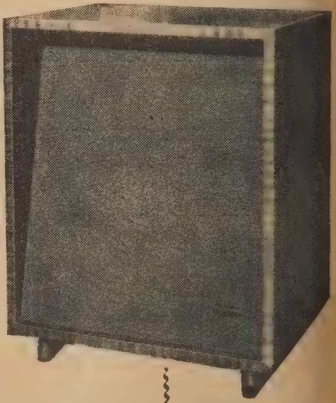

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violin stands out well from its
ɔund without being unduly pro-
, and despite a reverberation a
igher than normal, everything is
ind sharp.
Romances follow the pattern of
ncerto, and on the whole there
reat deal of fine music on this

ould be difficult to fit it all in
t some sacrifice of dynamic range,
: nature of the recording doesn't
l it.
nake the most of the available
the first side opens with Romance
and the second ends with No 2.
is a very good, smooth produc-
nd I'm sure it will win many

* * *

**ALO—Symphonie Espagnole in
inor Opus 21. Played by Bron-
Gimpel and the Munich Phil-
ıonic Orchestra, conducted by
Reiner. DGG LPEM 19071.**

most impressive recording of this
s that of Stern for Coronet. It
tremendous amplitude, and Stern
es a powerful performance.

if you are looking for one which
nts more completely the sensitivity
icism of the music, you will look
new disc, whose only rival is an
Decca with Campoli.

ıany ways these two have much in
n, but I would choose Gimpel,
while technically the equal or
r to Campoli, plays with greater
and even greater deftness.
recording itself is rather remote
t expect to find one of those over-
ngly vivid violin recordings in
the bow brushes the end of your

ıs been engineered in concert-hall
with no obvious attempt to vary
lance in the softer passages.
impel has a powerful arm it doesn't
r very strongly here, and there are
when closer miking it would have
.
erwise I thought this a lovely re-
The music is a favourite with me,
r that matter its charm and tune-
are immediate to everybody.
e it best to date.

* * *

**TRAVINSKY — Petrouchka.
ed by the Philharmonia Orches-
conducted by Efrem Kurtz.
V OALP 1503**

ouchka was already famous in the
of ballet when recording came into
n, and it was a perfect medium
ecca's LP of about nine years ago
created a sensation in the indus-

t disc, by Ansermet and the Suisse
ıde orchestra, made many reputa-
and has now become part of
phone history.
e then, a number of versions have
released, and in each case the
ing engineers have undoubtedly set
surpass it.
ıas become, with Pictures at an
tion by Mercury, an unofficial test
for all.
ar, only Dorati for Mercury, with
me orchestra which made history
he Pictures, has clearly exceeded
s milestone. This latest member
family would also be granted
onour, but not so clearly.
ay this because Dorati's disc is outstandingly good for its immense frequency and dynamic range, and for the excellence of its theatre.

After all, this is ballet music, and no matter how we rationalise a concert version, must retain the essential drama and point of the score.

I don't think Kurtz has realised this nearly as well.

The most obvious example is in the closing passages in which Petrouchka is slain by the Moor, to lie a pathetic and twitching heap on the stage until the Magician, dragging the mess of rag and sawdust into the wings, is horrified to see the spirit of his puppet mocking him from the roof of the stall.

The music is alive with every moment of this, and Dorati does it so well as almost to make up for the absence of the scene.

But Kurtz's drama is rather dim.

In the main, it is the story of a good version being overshadowed by an exceptional one, for there is no doubt that the Philharmonia plays well.

* * *

BRAHMS—Double Concerto in A minor Opus 102. Played by David Oistrakh (violin), Pierre Fournier (Cello) and the Philharmonia Orchestra conducted by Alceo Galliera. Columbia 33OCX 1487

This was the last orchestral work of Brahms, and in some ways it is a curious combination. Quite a few major composers have written concertos for more than one instrument.

The single instrument concerto is a comparatively recent development if we consider the history of music as a whole.

In the main it has a greater impact than one in which more than one soloist is used, for it has a unity of thought and of purpose almost impossible to obtain where the interest is divided between multiple players and types of instruments.

The over-all effect of this concerto is unique. In selecting instruments at opposite ends of the string family Brahms has used them to enlarge the orchestral texture rather than to give them the full lead.

Their contribution, of course, is a most important one, and we hear them individually almost from the start, but their work is complementary in sustaining movement and force of ideas.

For this reason, it is difficult to avoid a sense of dispersal and lack of cohesion, nowhere more apparent than in the first movement, which is the heart of the work.

It is almost inevitable, too, that one or other of the soloists will assume a lead which, by implication, was not intended, otherwise there would be no point in specifying two instruments in the first place.

In this instance it is the cellist, who announces his presence in the first few bars, and who overshadows his colleague whenever opportunity allows.

Some of this is due to the caprice of recording, which, in demanding that particular attention be paid to the instrument with the least naturally prominent voice, cannot avoid highlighting its strength which emerges under close miking.

Very few cellos sound as powerful on the concert platform.

Oistrakh, in addition, is unusually re-

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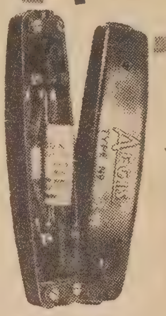

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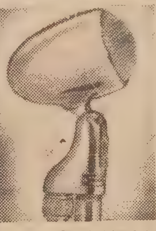

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1765	"	" " "	385-CT-385	" "
1766	125	" " "	285-CT-285	" "
1767	"	" " "	300-CT-300	" "
1768	"	" " "	325-CT-325	" "
1769	"	" " "	350-CT-350	" "
1770	"	" " "	385-CT-385	" "
1771	150	" " "	285-CT-285	5V-3A; 6.3-2A: 6.3-CT-2A
1772	"	" " "	325-CT-325	" " "
1773	"	" " "	350-CT-350	5V-3A; 6.3-3A; 6.3-CT-3A
1774	"	" " "	385-CT-385	5V-3A; 6.3-CT-3A; 2.5-5A

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1775	150	200 — 230 — 240	385-CT-385	5V-3A: 6.3-3A: 6.3-
1776	175	" " "	285-CT-285	" " "
1777	"	" " "	325-CT-325	" " "
1778	"	" " "	350-CT-350	" " "
1779	"	" " "	385-CT-385	" " "
1780	200	" " "	350-CT-350	" " "
1781	"	" " "	400-CT-400	" " "
1782	"	" " "	450-CT-450	" " "
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Valves: As 931-15.
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Sec.: 3.7 or 15 ohms.
Resp.: 10-60,000 cps.
Valves: 807, KT66, etc.
19% Screen Taps.

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Prim.: As for 921-15.
Sec.: 2 or 8 ohms.
Resp.: As 921-15.
Valves: As for 921-15.
19% Screen Taps

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Sec.: 3.7 or 15 ohms.
Resp.: 10-50,000 cps.
Valves: 6BW6, 6V6, KT61, etc.
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TYPE 916-8: 12 watts.
Prim.: As 916-15.
Sec.: 2 or 8 ohms.
Resp.: As for 916-15.
Valves: As for 916-15.
19% Screen Taps.

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Sec.: 2 or 8 ohms.

TYPE 872 — 12 watts.
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Sec.: 3.7 or 15 ohms.

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OUTPUT TYPE

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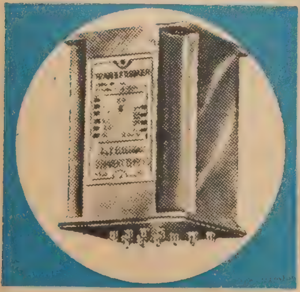
914	15	5000. 3000 P.P.	500. 250, 166, 125 and 106
915	15	5000, 3000 P.P.	15. 12.5, 8, 3.7 and 2
917	15	10,000, 8000 P.P.	500, 250, 166, 125 and 100
918	15	10,000, 8000 P.P	15. 12.5. 8, 3.7 and 2
922	25	8000 P.P.	500, 250, 166, 125 and 100

Type	Watts	Primary	Secondary
891	35	6600 P.P.	500. 250. 166. 125 100. 83 ohms
892	55	3200 P.P	500. 250. 166. 125. 83 62 and 50
928	5	7000, 5000 S.E.	12.5. 8, 3.7 and 2
929	10	4000, 2500 S.E.	15. 12.5. 8, 3.7 and
930	10	4000, 2500 S.E.	500, 250, 125
932	7	10,000 P.P.	15, 12.5, 8, 3.7 and 2



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and perhaps less happy in the
f the music, but his mastery is
there, and it would be hard to
r any standard of balance where
mplex values are to be accomo-

g made these remarks, there is
ore to say except that the over-
lt isn't just good as we would
-it is mostly superlative.

important and beautiful music,
strongly commend it to every
over as a disc not likely to be
for many a day.

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orous treatment, but its quality
ient to make it a valuable asset
ort.

ally and technically, this is very
ive star standard.

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chever way you look at it, some-
st steal someone else's thunder.

Philips version was made origin-
ne years ago, and it was a very
ne, not bristling with high spots
n very few of the obvious flaws
e spectacular issues.

instance its choral section was
among the best in that the voices
eaner and less liable to distortion
some others.

time later it was issued a second
it from newly made masters.

s obvious that someone had been
to highlight its sound, for it
d a much re-inforced bass end
thought improved it, plus other
ndable features.

only difficulty was that, in bring-
the bass, a hum had made its
nce, clearly heard on high quality
ent.

then, is the third version of
Ninth, and it bears more relation-
the first issue than to the second.

ith the Vox, compressions have
ade, but they are judicious

general consumption, in which
commercial radiograms will be
don't suppose many will notice
ifference, but for the sake of the
ho have something better, I hope
ion of fore-shortening big works
et out of hand.

ite the optimistic reports of some
rs, there is a difference, and
of listeners want to avoid the com-
and will pay the extra money
o.

the Philips version you are
You can take your pick, and
uy is a good one.

* * *

**CH — Toccata and Fugue in
or, Preludes and Fugues in E
A minor, C major and C minor.
by Albert Schweitzer (Bach
Music Volume 1). Coronet
92.**

and Schweitzer are almost syn-
s today, for the latter's reputa-
a player of the great organ works
l wide.

It is for this reason I think his records will be valued most, and, to tell the truth, there are not many other versions to be had.

The recordings are satisfactory without being brilliant, the only flaw being a change of pitch when the A minor fugue comes in, probably due to the tape machines. A pity this couldn't have been adjusted, for it's just enough to be a worry.

The better one knows Bach, according to Schweitzer, the more one learns to play him slowly. This principle is carried out on this record, for the tempos are extremely steady.

Some of it I feel may be due to tired fingers, for the organist is an old man, and, although this record was probably made a few years ago, not as deft as he used to be.

But, despite any such criticisms, the day will come when people no longer able to hear him in the flesh will turn to his recordings to find out how Schweitzer did it.

And this alone gives them a particular value.

* * *

DINNER MUSIC FOR PEOPLE WHO AREN'T VERY HUNGRY. Spike Jones demonstrates your Hi-Fi. Twelve numbers on two sides. Verve MG V-4005.

Hilarious high-fidelity with a great deal of typical Spike Jones foolery throughout.

Many of them are deadly plagiarisms of popular artists well known on records.

George Rock's "Little Child" in imitation of Frankie Lane and Jimmy Boyd is a natural. The Sow Song and the barking dogs who break into the number popularised by Dean Martin are only two highlights.

A couple of old favourites brought to life are the Blue Danube and Chloe.

Altogether there are 45 special noises, not forgetting the 1911 Black Hawk Stutz which somehow get in.

The recording is very definitely hi-fi, with tons of range and a nice, quiet surface.

Maybe the sibilants are overcut a trifle, and an isolated, difficult note below perfection, but only the meticulous will bother about that.

If you are a Spike fan you will know what to expect.

* * *

SYMPHONIC DANCES — by Tchaikowsky, Kabalevsky, Grieg, Weinberger, Ravel, Gleire, Bizet, Massenet, Delibes, Khachaturian, and Saint-Saens. Played by the Hollywood Bowl Symphony Orchestra conducted by Felix Slatkin. Capitol P-8369.

No one can complain of short measure—here are eleven of the most popular from the light classical field, and all types of music are represented.

None of them places much strain on the orchestra, but it plays them all easily and competently.

The sound is typically clean Capitol, situated in the mid-distance and with no favourite frequencies.

It sounds well on any kind of gear, and very good indeed on a good outfit with a goodly level.

Of its type it can be recommended.

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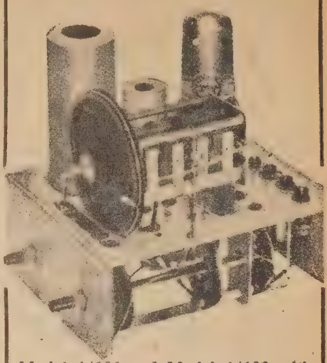

Model 4/101 and Model 4/102 with calibrated dial and handsome perspex escutcheon—

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* * *

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As a companion to the Geloso VFO unit the same manufacturer offers a band-switched Pi-Coupler with a tuning range of 3.5 Mc. to 28 Mc. of small dimensions and having the capacity of 807 or 6,146 output into a load of 40 to 1,000 ohms. Wound on high quality ceramic former—

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* * *

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UM2 **60** watts Audio, 200 Ma. max. current **£10/13/3**
UM3 **120** watts Audio, 250 Ma. max. current **£12/2/6**

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* * *

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Another new

ROLA

LOUDSPEAKER

Model 12MX, the latest addition to the Rola range, has been designed to give improved reproduction from better class amplifiers, radiograms and TV receivers.

This new, low-cost, triple-cone loudspeaker, does not need special baffles—it works excellently in conventional open back cabinets and has a frequency response and power handling capacity which is outstanding in its price class.

The frequency response of Model 12MX extends from 60 to 11,000 c.p.s. and is extremely smooth throughout. The large area of its 12" diaphragm provides excellent bass, and the low frequency performance of Model 12MX is notably free from 'boom'.

All in all, this is an outstanding loudspeaker for the radio, radiogram or TV user who seeks high-grade sound at moderate cost.

BRIEF SPECIFICATIONS

Fundamental Resonance	65 c.p.s. ± 5 c.p.s.
Frequency Response	60 c.p.s. — 10 k.c.
Power Handling Capacity	7 watts

ROLA COMPANY (AUST.) PTY. LT

**CHARD STRAUSS—Sinfonia
estica, Opus 53. Played by the
State Orchestra, Dresden,
ucted by Franz Konwitchny.
LPM 18331.**

symphony, or tone poem if you
a musical portrait of married
the Strauss family, and as such
ably meant a good deal to the
er.

by following the score or the
me, and being suitably impressed
right moments, no doubt the
can be at one with him should
lesire.

is so often happens when a com-
onsciously bends his talents to a
occasion, there is much difference
nion as to the successful out-

with those who agree with con-
al criticism which says this is a
ng and involved way to portray
lomestic relations in detail, no
how happy these may be.

it more rewarding to forget the
nme and listen to the music as
it.

all, the jacket notes remind us
rauss declared he saw no dif-
between absolute and programme
as it concerns this work. I can-
low him in this.

it is big enough and well enough
to be taken seriously.

istically it is most reverberant,
dangerously so. Otherwise the
ng is good, and the concert hall
here at which it aims is convinc-

lds trailing ends to the sounds,
many passages blend into a not
ant overhang, and this robs many
ts of the impact they should have,
orchestra has plenty of size. Fre-
and dynamic range are good,
t as wide as they would have
ith a closer recording technique.

* * *

**HANN STRAUSS — Fleder-
, with new lyrics and libretto in
ish featuring Lily Pons, Ljuba
tch, Richard Tucker, Charles
nan, Martha Lipton, John
nlee, and the Chorus and Or-
ra of the Metropolitan Opera
ciation conducted by Eugene
andy. Coronet KLC 612-613.**

net have turned out a tasteful and
ative production, with a full and
glish text as used by the Metro-
Opera of New York.

ough the records themselves con-
ly the musical numbers, together
few examples of the spoken lines
tie it all together, this text is
greatest value to the listener.

aps it is as well that we don't
all, for those members of the
ho do speak are not particularly
ing.

is perhaps the fate of most per-
ces in which English words are
Few operas are blessed with good
and generally sound best when
language is used, provided we
what is going on.

ems much harder to do it well
mother tongue.'

ntly Columbia issued a version of
maus with a European cast and
ilharmonic Orchestra. It was a
issue, and makes comparisons ex-
difficult.

The recording of the Coronet set is more forward and in many places better than Columbia's, but the latter had a bloom to it which the Metropolitan cast don't match.

It also had the superb presence of Schwartzkopf, who is particularly good in such things.

Lily Pons is the darling of the American opera world, but she hasn't the same charm, and it must be confessed, doesn't always sing precisely in tune.

It would be rather tedious to present a detailed comparison of all the characters. It is simpler and just as effective to say that I thought the Coronet version a lively and gusty performance, and well recorded at that. But it is not as smooth nor as subtle as Columbia's in which, by the way, John Brownlee is heard as Dr Falke.

It is presented by the best team America is likely to gather together, and that isn't to be taken lightly.

Technically it is extremely good, with clean sound and quiet surfaces. And if you like to hear and understand the words, you will find the new text an advantage.

* * *

CHABRIER — Espana Rapsodie; RAVEL—Rapsodie Espagnol; IBERT—Escales. Played by the Detroit Symphony Orchestra, conducted by Paul Paray. Mercury MG 50056.

The quality of the recording hit me first and hardest. It is one of those brilliant, single-mike Mercurys in which every tiny touch of a triangle and brush of a bow comes out with a realism that seems to hang in the air.

It is interesting to play Ravel's Rapsodie by Karajan for comparison. Believe me, there is plenty of it.

Paray is one of the pacy, precise school for whom all music is a challenge to efficiency.

Because of his faster tempo, the whole atmosphere of those opening bars take on a different light from that of Karajan.

I have rarely heard such a contrast between conductors. You might say that Paray matches Karajan's understatement with his own overstatement.

An example is found in the last few bars of the first section. There is a flourish of a flute which Karajan handles in a shapely sweep, and which Paray produces with a penetrating flourish.

I don't mean by all this to talk down the Paray record. It is far too brilliant musically and technically for that.

Its high tempo does, I think, take warmth from many of the colours, and some passages in Escales, for instance, are attacked with what I can only describe as ferocity.

Ibert's own recording for Capitol does not hit nearly such a high temperature.

The Detroit Orchestra is at its best. I can only admire the technical accomplishment of such fine playing.

Chabrier's exciting and memorable contribution is cast in the same mould.

When played at high volume, as such a disc demands, there is some tape background, and rumble too, I fear.

Nevertheless, it is a notable issue, so brilliant that one just can't overlook it.

Cutting amplitude is very high—it makes a big noise.

Dynamic range, too, is extremely good.

Music in the
MERCURY
manner!

BRASS in HI-FI

BRASS IN HI-FI
Pete Rugolo and his orchestra
My Mother's Eyes; All The Things You Are; Can't We Talk It Over; God Child; Brass At Work; Temptation; Song For Tuba; A Rose for David; Everything Happens To Me; Salute.
MERCURY MG20261

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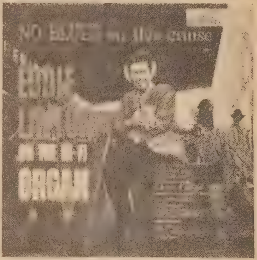

NO BLUES ON THIS CRUISE
Eddie Layton on the Hi-Fi Organ
Song Of India; Under Paris Skies; The Breeze and I; Arrivederci Roma; Blue Bells Of Scotland; On A Slow Boat To China; The Dypso Calypso; Green Sleeves; How Ya Gonna Keep 'em Down On The Farm After They've Seen Paree; Sweet Leilani; One Fine Day; El Relicario.
MERCURY MG20308

* * * * * * * * * * * * * * * * *

PATTI PAGE — PAGE 1
Don't Blame Me; I Don't Stand A Ghost Of A Chance; I Only Have Eyes For You; Ev'ry Day; Stars Fell On Alabama; I'll String Along With You; Stay As Sweet As You Are; Red Sails In The Sunset; Nobody's Darlin' But Mine; East Of The Sun; I Wished On The Moon; It's Been So Long.
MERCURY MG20095
Pressed by the manufacturers of
ASTOR Quality Radios, Radiograms, T.V.

SHORT-WAVE NOTES BY ART CUSHE

NEW CALLSIGNS FOR TAIWAN

Some new callsigns and frequencies have been assigned to the Broadcasting Corporation of China at Taipeh.

THE B.C.C. advised our reader Arthur Harris, of Benalla, Vic., that if sufficient letters are received from Australia and New Zealand, it is possible that a service to this area may be commenced by the station. At present it carries transmissions to most other areas of the world, and as the listening to the station is carried out here by many radio enthusiasts it would be expected that such a service would be commenced shortly.

The broadcasts from Taiwan are carried on the following schedule.

North America and Hawaii, 1130 a.m. to noon, on BED66 9575 Kc, BED6 11815, BED57 15345, BED63 on 17810 Kc.

English is broadcast from 11.30 to 11.45 a.m.

Transmission to JAPAN and KOREA, 8.05 to 9.20 p.m. on BED7 7130, BED66 9575, BED6 11815, BED57 on 15345 Kc. English is for the first 25 minutes, 30 minutes in Japanese and the last 20 minutes in Korean.

Transmissions to SOUTH EAST ASIA, 9.30-10.35 p.m. on BED7 7130, BED66 9575, BED6 11815, BED57 15345 Kc. English from 10 p.m. to 10.35 p.m. Second transmission from 11.0 p.m. to 2.0 a.m. on BED66 9575, BED64 on 11840 Kc.

Transmission to the Middle East, 5.20-5.40 a.m. on BED7 7130, BED6 11815 Kc.

Test from Tangier

TEST broadcasts from the Voice of Tangier have been logged by Ronald Pearson, of Parramatta, N.S.W., who has been hearing the station at 6.30 a.m.

The station was testing a new antenna system for reception in Europe and was very strongly received. The program was released on 9490 Kc and included choir items, in various languages. Reports were requested to Voice of Tangier, Post Box 2219, Tangier, North Africa.

NOTES from listeners should be sent to Arthur Cushen, 212 Earn Street, Invercargill N.Z. All Times are Australian Eastern Time.

Radio Sweden Schedule

THE present schedule as broadcast from the Stockholm station includes some changes in program times, and the complete transmission lineup is now as follows.

North America, 11.0 a.m.-12.15 p.m. on 11810 Kc, midnight-12.30 a.m. on 17840 Kc.

U.S.A. East Coast, 12.30-1.45 p.m. on 11810 Kc.

Mexico 2.0-2.45 p.m. on 11810 Kc.

South America 9.0-10.30 p.m. on 9660 and 11705 Kc; 11.0 a.m.-1.15 p.m. on 11705 Kc.

Africa from 3.45-5.0 a.m. on 17840 Kc; 5.15-6.15 a.m. on 11705 Kc.

South Asia, 12.45-2.0 a.m. on 15240 17840 Kc.

Far East 10.30 to 11.45 p.m. on 15240, 17840 Kc.

Europe, 6.30 to 8.0 a.m. on 7210 Kc.

Middle East, 2.15-3.30 a.m. on 11705 and 17840 Kc.

New Tokyo Call

THE Home Service of the Japanese Broadcasting Corporation operates several 5 Kw and 10 Kw transmitters to relay the local programs to listeners in outlying islands. Recently the service has been noted on 11800 Kc, with a new callsign in use.

The station is best heard after 8 p.m. when Cologne on 11795 Kc leaves the air to give the Tokyo signal a better channel. The station is usually carrying Japanese local programs and announces with the NHK break at 8.30 p.m. but no key station has been included with these announcements, is presumed that the program is from JOAB in Tokyo and carries the first network programs. Other stations are also known to have changed callsign, the former call on 11800 Kc was JK14 and it is now JKH3.

NEWS FLASHES FROM EVERYWHE

FRENCH SUDAN which has been mentioned on this page before, has now been verified by a Cyprus listener, who sends information on Radio Sudan at Bamako. The station operates daily from 4.30 to 5.15 and 10.15 to 11.10 p.m. on a frequency of 9745 Kc, and also from 5.0 a|m| to 7.0 a.m. and at times to 8.0 a.m. on 4835 Kc. The station uses a 4,000 watt transmitter and a temporary aerial which is soon to be replaced by a permanent system. The station verifies reports; address to P.O. Box 171 Bamako, and the Station Director confirms the reception reports.

SALISBURY using 3396 Kc from Southern Rhodesia, is reported to be relaying the B.B.C. Radio newsreel program at 3.0 a.m. daily.

NORWAY is reported with its popular program in English on Monday at 3.0 a.m. It is called "Norway this weekend." It has been heard as late as 3.35 a.m. and uses the frequencies of 11735, 15175, 17825, and 21670 Kc.

DAMASCUS in the new United Arab Republic, and formerly Syria has been heard over the past few weeks with the usual English news broadcast at 6 a.m. and using the frequency of 15165 Kc. The programs from Damascus are normally verified with a large folding card, which is usually sent by registered mail.

ILOILO CITY station of the National Civil Defence in the Philippines has been heard by William Hawthorne of Warrnambool Vic., opening transmission at 8.30 p.m. in the normal broadcasts of NDCA. The station appeared to close at 9.30 p.m. after a musical program.

FREEDOM station using the slogan Radio Free Russia on the frequency of 11600 Kc, broadcasts from 2.0 to 6.20 a.m. on 6400 and 6800 Kc also. Transmissions are in German every Saturday and Hungarian on the first and fifteenth of each month, while Bulgarian is released on the tenth and twenty-fifth of the month. Reports can be sent to Berlin address, or Box 346, Luxemburg.

TASHKENT which was reported recently in this page, has now settled on 11690 and has news in English at 10.30 to 11.0 p.m. and repeated at 2.30 to 3.0 a.m., the transmission is beamed to India and Pakistan.

HAITIAN station 4VW1 has been heard in New Zealand on 11800 Kc which has replaced the 19 metre band channel at 7.30 p.m. The has a fair signal but at 8 p.m. suffers inte from the Tokyo station JKH3 on the sam length. 4VW1 is in parallel with 4VE us Kc but the latter is only weak in strength

CUBAN station COBL broadcasting Havana seems to be on a 24 hour a day and has been heard in New Zealand normal frequency of 9833 Kcs from 5 after 6.30 p.m.

BUDAPEST in the new transmission t East Asia, advises that this is carrie 10.30 p.m. to 11.0 p.m. and repeated p.m. to midnight using the frequencies 7220 and 6195 Kc.

TANGIER station 18RA which has fr been heard in this area on the usual channels has moved from 11342 to 11458 other frequencies are 9275 and 14858. Sig heard best at 7.15 a.m. in English.

RADIO DAKAR in French West Afr added the additional frequency of 5980 ports the Swedish DX Session, and w 11895 Kc outlet, is on the following s 4.30-6.0 p.m., 11.0 p.m.-12.45 a.m., 6. 10.30 a.m. On Sundays from 6 p.m. to 9 on Monday, also on 4950 Kc.

LISBON in the relay of the Home Ser changed the frequency to 6373 Kc, with grams of Emisora Nacional, which were on 11996 Kc. The station is on the a 4 a.m. to 10 a.m.

SEOUL has been reported by Dick Po Golden Downs, N.Z., as operating on frequency of 7010, with native program 6.30 p.m. The station uses the usual KB break but does not appear to be in cha the station on 7180 Kc.

NIGER is the latest country to plan o on shortwave and Radio Niamey, Niger, h assigned the following frequencies, 3260 7105, 9610, 9710 and 11775. The stati possibly use the two lowest frequencie operations commence.

BELGIAN CONGO station OQ2AD, diffusion UFAC, Section del 1 Union des Combattants du Katanga, Elizabethville, u watts and operating on 4980 closes tran daily at 6 a.m.

ECUADORIAN station HC1GP has callsign to HCRCX, and operates from 10 2.30 p.m. on 5010 using the slogan Radi lica, Quito. HC2GI Radio El Telegrafo quil, operates from 10 a.m. to 2.30 4710 Kc, while HC4MX Radio Cenit, Po on 4700 Kc, operates from 10 a.m. to 2.

PRAGUE in the transmission to Austra New Zealand recently made some fr changes. The session from 6.30 to 7. is now carried on 17815 and 11835. Th mission for Europe from 8.00 p.m. to 9. 10.15-10.45 p.m. is carried on 15145 an Kc. The transmission 9.00 a.m. to 3. for South America is now on 11935 11900

BAGDAD broadcasts with a new 100 K mitter to 7180 Kc, 2.30-4.30 p.m., 6.0 7.00 a.m. in Arabic only.

ANGOLIAN station CE6RE, Radio Malange, on 7245 Kc with 250 watts, is o 5.00-6.00 p.m., 10.00-midnight, 4.00 a.m. a.m. on Sundays the transmission is p.m., and 11.30-7.00 a.m.

ANGOLA transmitter CR6RC broadcasti Luanda, on 11862 Kc, has been heard USA from 7.20 to 8 a.m. with Latin A music, and identification was heard at 8. with the station leaving the air at 8.30

BRAZIL with its wealth of stations is ally in the news each month. The learned from the World Radio Handb that ZYS33 6045 Kc, and ZYN29 959 now in operation. ZYN32 is on 11875 w callsign on 11815 Kc is ZYW24. Radio is again operating PRB24 on 11965 K 7500 watts.

RADIO CANADA STATIONS

The broadasts from Montreal by the Canadian Broadcasting Corporation are well received by readers, and this list contains all the callsigns and frequencies.

KCS	CALLSIGN
5970	CKNA
5990	CKAY
6060	CKRZ
6090	CKOB
6160	CHAC
9585	CKLP
9610	CHLS
9630	CKLO
9710	CHLR
9740	CHFO
11705	CKXA
11720	CHOL
11760	CKRA
11900	CKEX
11945	CKNK
15105	CKUS
15190	CKCX
15255	CKSB
15275	CKBR
15320	CKCS
17710	CHSB
17735	CHRX
17820	CKNC
17865	CHYS
21600	CKRP
21710	CHLA

A NEW TRANSMITTER HEARD FROM BRAZI

The many Brazilian signals we are hearing at 7 p.m. and onwards has been ad to this month by the reception of further stations from this country. The best si is that of the Manaus transmitter on 9695 Kc broadcasting from the heart of B on the Amazon headwaters and heard daily opening transmission at 8.05 p.m. station at times is a few moments late in opening, and the march "El Capit opens the programme for the day. The station identifies as "Radio Riomar, Man Brazil," stations ZYL22 on 9695 Kc and ZYB20 on 1480 kilocycles. The station a a short news summary at 8.15 p.m. has been heard with light music, generally United States origin. There is some interference from the Los Angeles transmi on 9700 Kc but this is not very severe.

HE HAM BANDS WITH BILL MOORE

all periods in amateur history, this is the one during which we should tell the world of history and our achievements in order that we may help preserve our future. Every amateur today should consider himself called to justify his existence.

of the most impressive statements yet ished covering the work of radio amad their contributions to radio techniques resentation by the ARRL to the FCC in of the present amateur occupancy of o 890 Mc/s portion of the spectrum.

CC is conducting a study of frequency that range and the ARRL's response is l in the January issue of QST.

tatement is well worth reading. Outcontributions especially on propagation na observations are listed hereunder.

iscovery of the practical employment of aves and their subsequent use by other was essentially an amateur accomplish- The first published explanation of the ric transmission of high frequencies was a radio amateur. Amateurs were first rve and demonstrate extended ground rking on the VHF bands by means of by the lower atmosphere

ASS BENDING

riginal investigations on "Air Mass Bendre begun in 1934 under the control of alian, the late Ross A. Hull then Techditor of QST. Extensive experimental as carried out on the 56 Mc band.

lic E propagation was first observed in en radio amateurs were amazed to hear n the 56 Mc/s band from distances rang- 500 to 1,200 miles. This was the first n that signals above 30 Mc/s would be or long distance communication.

ustralia signal reports of stations were above 300 miles.

37 amateurs discovered that during periods ked magnetic disturbances, signals could d over much greater than normal disif the directional antenna arrays were toward north rather than toward one

ose days very little was known of Aurora and these amateur observations were used umber of American universities in study- Aurora.

the war with improved VHF equipment it was possible to observe similar effects Mc/s transmissions. In 1948 and in roral communication was established on Mc/s amateur band.

the change postwar from the 56 to 60 and to 50 to 54 Mc/s amateurs had im- opportunity for DX working. In 1946 tablished communication between Great and U.S.A., the highest frequency ever r radio communication across the Atlantic. then F2 layer reflections have been ree for amateur communication being exon this band to a distance of 12,000 miles. 47 a new propagation medium was observed on 50 Mc/s called "Equatorial Scatter." Often when the predicted maximum usable frequency was as low as 25 Mc/s 50 Mc/s communication was established between the U.S.A. and stations south across the equator. Experiments are still being conducted on this form of propagation.

METEOR TRAILS

In 1953 amateurs using the 144 Mc/s band heard snatches of signals from distances many times the normal range at that frequency. It was suspected that the signals were reflected from meteor trails as they were more often heard during meteor showers.

A day-by-day check over two years made by a number of amateurs, showed that signals could be returned to earth from meteor trails in the ionosphere.

This knowledge is now being put to work and promises to be a means of consistent long distance working with a high degree of secrecy—an important military objective.

Currently an important project is IGY propagation study and some 1,200 amateurs throughout the world under the U.S. National Academy of Science are co-operating. These amateurs are giving freely of their time to collect information on VHF band operation. It is anticipated that this information will shed new light on the previously mentioned modes of propagation.

Another useful work performed recently by amateurs was the reporting on the 20 and 40 Mc/s signals from the Russian satellites. These frequencies were too far removed from the 108 Mc/s Minitrack installation to allow them to be used and amateurs throughout the world were requested to supply information on the signals.

AMATEUR REPORTS

During the first days of the satellites, eye reports received by official organisations were practically exclusively from amateurs.

The number of reports available would have been greatly reduced only for the co-operation of this group of skilled volunteers.

The article continues to explain the uses to which each of the VHF and UHF amateur bands are being put and the outstanding features of each allocation.

In conclusion the League states that the current U.S. amateur population is 160,000, increasing at the rate of 12,000 each year. At a most conservative estimate the 200,000 mark will be reached at the end of 1960.

The 300,000 mark should be achieved in 1967, only 10 years away.

The document is an illuminating study of the work of a group of scientifically inclined private citizens and a clear account of the contributions of radio amateurs toward a further understanding of the workings of the ionosphere.

AMATEURS CO-OPERATE IN THE IGY

outstanding contribution by amateurs in is country toward the IGY program has e operation of members of the N.S.W. nd TV group in their recording of the of satellite Alpha 1958 in its orbits across Eastern Australia.

ssions of thanks have already been refrom IGY headquarters in Adelaide for o-operation.

s been a task that has taken many hours e (?) time and meant operation in the ours on many occasions.

mation on the satellite's progress has been to two sources—firstly to the Amateur mers' Moon Watching Station at Bel- Sydney and to Gordon Bowen, VK5XU, at l.

the latter it is then passed to IGY HQ, e, and finally to Woomera. The l link also provides information for the s station from Woomera. Amateur radio o supplied another relay link from Wooo U.S.A.

on 14 Mc/s has been used by VK5WC, of the Woomera Radio Club, for the ssion of information on IGY projects to a.

main contribution to the study has been y Hugh Stitt, VK2WH, of Forbes, Neville VK2DR, of Blayney, and John Miller, NF, of Sydney. During orbits of Alpha to be passing within a reasonable distance ney, the transmissions on 108.0 and 108.03 have been monitored.

three stations have been linked on either 5 or 7 Mc/s bands depending on pro- n conditions and have supplied warnings on the first appearance of the satellite's signals.

Further warnings are supplied until the signals reach their peak strength. The time elapsing between the first recording of signals and their maximum depends on both the height of the moon and its path on that particular orbit.

Since the batteries failed on the higher power (60 milliwatts) transmitter on 108.03 Mc/s, monitoring has continued on 108.00 Mc/s.

The 108,00 mc/s transmitter runs 10 milliwatts and is anticipated that it will stop on the air for two to three months. The transmitters each weighed 2lb, complete with batteries.

Four special "Microlock" detecting stations are plotting orbits. The receivers freeze to the signal, measuring the shift of frequency and use it to estimate the satellite's speed Directional antennas pinpoint its position.

The lower power 108.00 Mc/s transmission has been difficult to copy in noisy locations.

Information from VK5WI has been passed to the Moon Watchers in Sydney by telephone. If there is any possibility of a visual sighting, the Moon Watchers are alerted and Bob Winch, VK2OA dashes to Belfields, sometimes in the middle of the night.

His 144 Mc/s mobile transmitter provides the final link from VK2ANF so that the early warnings from VK2WH and VK2DR can be utilised.

It is likely that these observations will continue for some time and it is usual to check three orbits per day.

It would appear that this work has provided invaluable information on the plotting of the orbits of Alpha and amateurs who have participated are to be congratulated on a useful contribution to the IGY.

NOVICE LICENCES

THE introduction of limited class AOCP licences in this country has made an impact on amateur population and the last 12 months has seen a healthy increase in the number of licensees.

They, too, have made a valuable contribution to experimenting on the VHF bands. Allan Hennesey, VK2ZAL, for instance, has been working JA stations on 50 Mc/s as well as establishing a VK2 to VK5 144 Mc band record.

Currently in the U.K. discussions and exchanges have been taking place on the virtues of "novice" licencees.

Opinion is very varied but following the success of novice and technical class licences in the U.S. and Limited AOCP operators in Australia there is no doubt that they can make valuable contributions to amateur radio especially on the VHF bands.

The main points of debate centre on the value of Morse and the possibility of the lowering of standards.

Those supporting the introduction of "Novice" class licences point out that many amateurs can no longer copy Morse Code at approximately the Novice speed of five words per minute.

One very good point in favour of Limited licences is that in the future more and more young people are being trained as tchnicians and scientists in the electronics field. Most of these youngsters would be able to take the technical examination in their stride but jib at the thought of spending much time learning Morse.

The introduction of these persons to amateur radio would populate the VHF bands, strengthen the movement, and the National Amateur Society

URUNGA CONVENTION

PROGRAM for the North Coast WIA's Urunga Convention includes many interesting events. It is the ninth annual event of the North Coast and Tablelands Zone and attracts members from all over the State and VK4.

Easter weekend, April 4, 5, and 6 is the period and Friday evening has been set aside for a discussion on WIA affairs and similar subjects.

Registration will take place on the Saturday morning and from 3 to 5 p.m. heats of the 144 Mc/s Blind and Hidden Transmitter search will be conducted.

Concurrently the Gerry Challender Remembrance contest on 7 Mc will be run.

A nocturnal 144 Mc Fox Hunt will be a feature of Saturday evening followed by a social. Sunday will be a full day with further 144 Mc Fox Hunts and an all band scramble, the night session includes a film show, concert and disposals auction.

Amateurs attending are assured of a pleasant weekend held in traditional amateur style—even if you make the convention at the last moment you will be very welcome.

Lectures to amateur bodies in N.S.W. presented in February were by Stuart Fairburn, VK2ZBF, on VHF equipment at the Hunter branch and Joe Reed, VK2JR, to the Central Coast Radio Club on Sputnik and allied subjects.

DELEGATE TO ITU

Although the fund for the financing of an Australian amateur delegate to attend the 1959 Berne ITU conference had not been officially opened over £100 has been subscribed in N.S.W. Amateur support for the whole scheme is gaining momentum and response is excellent.

Plans are still being prepared by Federal executive on the expected coverage of such a delegate and it will be necessary to select an able spokesman with wide experience in negotiation and organisation at conference levels.

The delegate will have much detail work to do before he leaves and the preparation of a report on his return will be a prolonged job.

It has been stated that such a delegate representing the amateurs of Australia would become an accredited member of the official Australian delegation to the ITU conference.

MINITRACK TESTS

As a test for "Minitrack" stations mentioned previously, a special 108 Mc/s signal was bounced back from the moon last December. The signals were heard by a number of radio amateurs. The transmitter used 50 Kw and a 60ft dish antenna. The experiment will be repeated on a number of occasions and amateurs reporting on the reflections will receive a special "Moon QSL."

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2-way Radio. with Genemotor and 15 standard valves. Good condition.

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Freight payable at nearest attended railway station.

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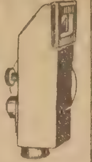

Horizon and Bubble Type, Brand new Mark IIIB.

Complete with Leather Case.

Dimensions. 9in x 4in x 2in. Ex-R.A.A.F.

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4 MFDS. 600V	4/
4 MFDS. 400 V	3/
1 MFDS. 350 V. On Bracket	2/
2 MFDS. 250 V	2/6

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DOUBLE
PHASE 1. FREQ. 50 CYC
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6.3 AMP CENTRE TAPPE
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5.1V AT 26 AMPS OUTPUT

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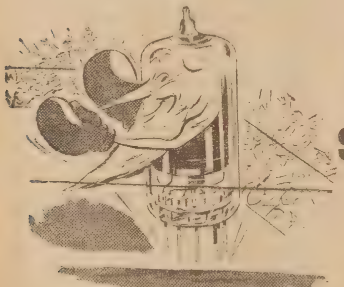
Between Crown and Riley Streets. City.



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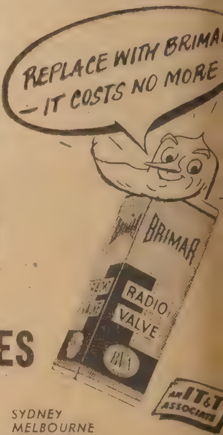
Long after other valves have lost their punch, Brimar "New Life" valves are still functioning reliably, with top efficiency. Brimar Valves give more trouble-free working hours, outstanding performance and reliability, because they're engineered by S.T.C. to live longer.



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U10

s during the first weekend of the
contest were excellent on all bands
7 Mc/s.

the sun spot maxima the 3.5 Mc/s
ied good W DX, Frank Hine, VK2QL,
2, 3, 6, 7 and 8 on that band.

PEN ON 50Mc

Y and February provided radio ama-
throughout the world with some extra-
ropagation on the 50 Mc/s band.

stant contacts were made over paths
ously covered. In February, according
Meyers, VK2VN, recently returned
.S.A., it was common talk of WAC's
0 Mc/s in a few days. Exact details
ailable.

number of WAC's have been accom-
W stations. The first has been credit-
LZ.

the final contact when he worked
L. W9DSP is another station who
the five other continents.

number of American stations have one
continent and when the full story is
50 Mc/s contacts during the last few
ite a number of WAC's will undoubted-
l.

part of the globe the two outstanding
date were made between K6RNQ and
s. The first was established with
February 1st.

ter he contacted ZL2ABX. Both QSO's
around 1,000 hrs. E.A.S.T.

FOR U.S.A.

er of North American stations are
contact VK's. XE1GE will be listening
perates just a few Kc/s inside the band.
that the best conditions will be ex-
during February- March and September-
KH6 and W6 stations are beaming
Australia each Sunday morning, calling
45 minutes past the hour.

from Macquarie Island (call unknown)
e automatic morse on 50.195 Mc/s each
tween 2,000 and 2,100 hrs. E.A.S.T.

between Japan and Australian sta-
rred on many occasions in February
s working dozens of JA's. VK2WH,
recorded 14 contacts in one session
of Z calls also established communica-
Japanese stations. Two other stations
ntry, VK2ADT and VK2AT6, of In-
ked many JA's.

s in Queensland enjoyed even better
George Heilbronn, VK4GG, has now
different JA stations in all districts
through to JA8. VK4ZAG, VK4KK
ber of other stations have worked many
tations.

's have also been heard calling ZL
ut it is not known whether contacts
established.

nately 15 openings occurred in February
times from 1,000 hrs. until 2,100 hrs.
About half extended to N.S.W.

g to Norm Burton, of Revesby, who is
d on 50 Mc/s activity in the U.S., the
t between W1 and KH6 was made on
—W1CLS and KH6UK were the sta-
erned TV reception across the Ameri-
nent was commonplace during these
he channel concerned was approximate-
nnel 2's frequency.

EUROPE

urope a number of stations have heard
cted crossband W6 and W7's, one G
aving worked the whole 10 W districts
the leading DX stations have now con-
r 25 different countries on 50 Mc/s and
steadily growing.

n experts consider March, and even
provide the best opportunities for Aus-
ateurs, especially those situated in the
of the continent.

blem that these conditions have pro-
U.S. is the low end crowding of the

mateurs, although running up to 1KW
ke use of cheap disposals crystals on
encies, with the result that when the
s dozens of stations appear on the one

point that has caused trouble is that
. Normally amateurs were not greatly
with some over-modulation. So few
eard it, anyway, and it did assist in
ground wave contact. The appearance
us signals from many areas has high-
e damaging effects of splatter.

distant contact has been spoiled by
ation's overmodulation.

tion on distant contacts on 50 Mc/s is
orded in each Australian State for relay
WIA, official Federal station, to IGY
ers. Similar action is being taken by
amateur radio societies throughout the
d it is anticipated the collating of re-
supply useful propagation data.

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There is no other **3-SPEED** recorder, no other recorder sold with a **ONE YEAR GUARANTEE**, no other recorder of such **SIMPLE AND RECENT DESIGN**. No Recorder sent anywhere **ON APPROVAL**.

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3 Motor
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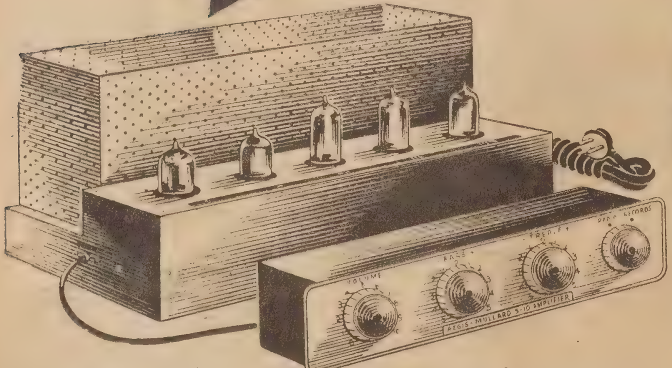

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ALL
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AEGIS MANUFACTURING
208 LITTLE LONSDALE ST., MELB. VIC.

A CONSOLE CABINET FOR YOUR TV SET

(Continued from page 51)

ıproving its appearance, lengths ch quad dressed moulding were to match the ply and these were the correct size and glued and to the back of the cabinet, the length of the sides and the top ttom.

is way, the cover plate, in pos- completely concealed from the f even the most inquisitive on-

e stated at the beginning of our this cabinet was designed so that nplete novice could duplicate it e least trouble.

applies particularly to the edges ply. To dress these edges in a onal manner requires some skill avoided this by selecting ½-inch ıt, fancy moulding, about ½-inch

:H THE GLUE

is cut to size, the surfaces lightly and then attached to the cabi- h small panel pins, the heads be- ıched slightly below the surface sequent filling

e glue used seeps out on to the of the ply, a wet rag will usually it, but it is a good idea to con- ubbing the rag over the whole so that the surface of the ply t be stained in patches.

the cabinet over carefully on to its side and attach, with glue and screws, the four pre-shaped legs.

The pores of the ply may now be filled, using a commercial filler and rubbing with a pad the whole surface across the grain, then rubbing off with a dry rag.

We selected a maple filler which coloured the surface a little to the desired shade.

After rubbing slightly with a very fine grade of sandpaper, French polish or go over the cabinet with clear lacquer and allow to dry.

In our case the cabinet proper was French polished, while the frame supporting the safety glass was clear lacquered. This gave a very pleasing contrast.

Before attaching the back cover plate, which, by the way, is made from Masonite or some similar material, allow plenty of holes for ventilation, as the interior of the cabinet becomes fairly warm during operation. As you can see from the photograph, holes are also cut to allow access to the various controls at the rear of the set, without having to remove the cover.

The small box fitted to the centre of the coverplate allows for the end of the picture tube and should clear the tube by an inch or two all round. The end of the box has been covered by a scrap of expanded aluminium left over from the speaker grill.

In the finished article a piece of gold coloured expanded aluminium cut to fit into the recess in the frame is held in position by the speaker baffle board, which, in turn, is held by cleats on either side, screwed into both the baffle board and the sides of the cabinet.

In concluding the article, we might add that a small, flat carrying handle attached to each end of the chassis will greatly assist in removing the set from the cabinet and in carrying it from place to place. These can be seen in the photographs and no difficulty is experienced in doing any under-chassis repair work or adjustments, as the chassis rests on the edge of the EHT box and the handle.

So much, then, for our easily constructed console TV cabinet.

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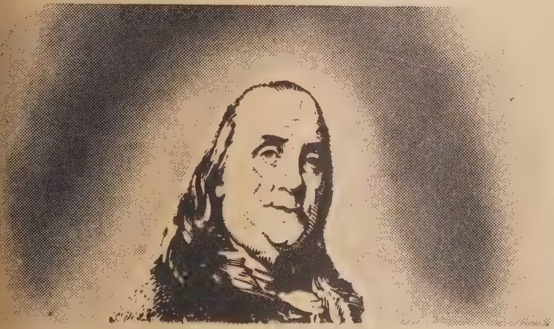
WHAT SECRET POWER
DID THIS MAN POSSESS?



Benjamin Franklin (a Rosicrucian)

Why was this man great? How does anyone—man or woman—achieve greatness? Is it not by mastery of the powers within ourselves?

Know the mysterious world within you! Attune yourself to the wisdom of the ages! Grasp the inner power of your mind! Learn the secrets of a full and peaceful life! Benjamin Franklin—like many other learned and great men and women—was a Rosicrucian. The Rosicrucians (NOT a religious organisation) first came to America in 1694. To-day, headquarters of the Rosicrucians send over seven million pieces of mail annually to all parts of the world.

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The 22 transceiver covers a frequency of 2 to 8 Mcs. and has been approved by the P.M.G. for use on fishing boats, small craft, bush fire brigades, etc., if converted to crystal control, for which it is easily adapted. These sets are supplied complete with valves, 12v. vibrator power supply, dynamic headphones and microphone leads.

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These units cover a frequency of 2 to 8 Mcs. and contain 15 6.3 valves' including 1-807, 2-6V6, 6-6K7, 2-6K8, 6B8, etc., also 500 mi ammeter.

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These 6-valve Walkie-Talkies are supplied complete with valves, h phones and microphone.

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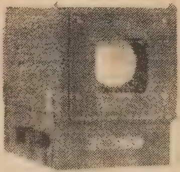
AMERICAN HANDY TALKIE. SUPPLIED WITH VALVES BUT LESS COILS AND CRYSTAL
TYPE BC/611, £8/15/-, POST AND PACKING 15/- EXTRA



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These new indicator units contain 3 valves, controls, etc., and V.C.R. ACR/10 C.R.O. tube and socket. Ideal for that small scope

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NEW MN
COMPAS
Control
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Drivers Fo
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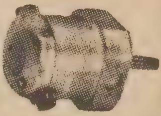

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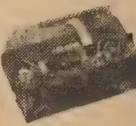

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27/

SPECIAL—FREE VALVE OFFER

WITH ALL ORDERS OF £6 OR OVER SIX NEW VALVES SELECTED FROM THE FOLLOWING LIST WI BE SUPPLIED FREE (COUNTRY ORDERS PLEASE ADD 2/6 EXTRA POSTAGE)

1Q5GT — 1C7G — 6H6GT — 6K7G — VR65A — EF50 — 954 — 6C8G — 1P5GT — 1K5G — 7193 — CV6 6J7G — 12SK7

NEW 3in. R.F. METERS

Supplied with New Scale to Convert to 0-10 or 0-100 MA. METER. 7/- PLUS 2/6 Postage.

LIFEBOAT TRANSMITTERS

These units use single 14.v Valve and have Telesco Aluminium Aerial. 17/6 Postage 4/- extra.

CO-AX CABLE

Light 90 Ohm Twin Co-ax
1/3 YARD, plus postage.

CO-AX. CONNECTORS

PYE TYPE . . . . . . 4/- Pr.
AMERICAN . . . . . 6/- Pr.

New Throat Micropho

3/6 plus postage
NEW MICRO SWITCHE
5/6 plus postage

METROPOLITAN RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE LM739
640 KING STREET, ST. PETERS, N.S.W. PHONE LA608

EW VALVES AT BARGAIN PRICES

1T4	10/
1S5	10/
3S4	10/
3V4	12/6
1R5	12/6
1A7GT	9/6
1D8GT	9/6
6A8G	10/6
6K8G	9/6
6SJ7GT	9/6
6X5GT	10/
12K8	10/
12SK7	7/6
EK32	10/6
6SA7GT	9/6
830B	12/6

6SH7	3/6
1Q5G	5/
1P5G	5/
1C7G	5/
1K5G	2/6
6AC7	2/6
6C8G	7/6
6S57	8/6
6F6G	9/6
6E5	8/6
6H6	2/6
6H6GT	1/6
6J7G	7/6
6K7G	3/6
6K7GT	7/9

6U7G	6/6
6Y6GT	12/6
6X5GT	10/
6J7G	5/
6U7G	5/
6J6	15/
6F8G	10/6
6A3	15/
7C7	3/6
7A6	3/6
78	7/6
71A	7/6
EL32	10/6
KTW62/6U7	6/6
VR65A	2/6

Please add Postage on All Valves.
SPECIAL PRICES FOR QUANTITIES.

CV6	3/6
42	12/6
7193	3/6
954	4/6
955	10/
12A6	10/
EF50	2/6
110TH	£2/9/
811	£1
866/866A	15/
828	£1/9/
12SH7	5/
12SL7	10/
6K7G	4/6
100TH	20/
866	12/

w Power Transformers

A prim.: 204v with 230v tapping, 285 x 285 with 6.3v filament ing.

22/6

s Postage: N.S.W. 3/6; INT. 5/3.

NEW
4in Per-Mag. Speakers

5T. or 7T. Trans., 30/.

30/-

Post. and Packing, 3/6.

w Midget Power Trans.

A Prim. 250v. Sec. 225 x 225 with . Fil. Winding. Upright or Flat inting. Size 2in v 2½in.

22/6

5 Postage, N.S.W.; Interstate, 4/6

A, 240v. Prim. 150 x 150v. Sec. 6.3v. Fil. Winding.

20/- **Postage, N.S.W. 2/6; Interstate 3/6.**

UILDING R. TV & H. TV SET

Major Parts in stock, including .S. IF Strips and Tuners. Valves, 'er Transformers, Chassis, etc.

NEW DYNAMIC HEADPHONES

se headphones made by Rola are a quality unit giving excellent tone. Fitted with comfortable ear pads.

22/6 **Post 4/6.**

NEW No. 7 HAND MICROPHONE

with Switch Dynamic Unit.
20/- Plus Post.

VALVE SPECIALS

20/- will purchase any one of the following Valve Specials.

5	1P5	3	6K8G
6	1C7	6	6SH7
5	1Q5	8	6AC7
12	1KS	5	6J7G
6	954	4	6U7G
6	6C8G	4	12A6
10	EF50	2	6X5GT
12	VR65A	7	6K7G

Post and Packing, 4/6 extra.
ALL VALVES ARE NEW.

NEW 6H6 OR 6H6GT VALVES

Individually Cartoned.

14 for 20/-

Post 2/6.

New Transmitting Valves

803	30/-
100TH	£1
866	12/-
811	15/-
830B	12/6

New Micro-Ammeters

New Paton Micro-Ammeters.
0-500, M.A. 1¾in diameter. Flush mounting.

25/-

Post and Packing, 2/6.

CONDENSER SPECIAL

Boxes of 100 new mica paper and electrolytic condensers in values ranging from 50pf mica to 5 400v. paper. Values include .0001, .00025, .00075, .01, .02, .05, .1. Also 500 mfd/12v., 10 mfd/40v., 8 mfd/525v., 16 mfd/350v., electrolytics.

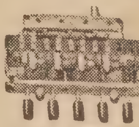
25/- **per 100.**

Post Extra: N.S.W. 2/6; Int. 3/6.

NEW VIBRATORS

A.W.A. Oak 6 volt Synchronous 7-pin base. 6/6
A.W.A. 12 V Synchronous octal base.
7/6. Post 1/6.

NEW PUSH BUTTON SWITCHES 20/-



Five pole push-button switches.
New control box fitted with above switch, also 5 bezels with globes and multi-contact by key switch.
Post: N.S.W. **2/-**
Int. **3/-**

NEW I.R.C. RESISTORS

I.R.C. carbon resistors, ½, 1 and 2 watt, in values 50 ohm. to 5 meg., including many popular sizes, 3T, 15T, 20T, 25T, 50T, 100T, 250T, 500T, etc.
(Standard resistor colour code supplied)

100 for 25/-

(Plus 1/6 postage.)

New High Impedance Headphones

27/6 · Post 1/6.

Telephone Generators

New small telephone generators, ideal for bell ringing, etc.

10/6 **Postage 3/- extra.**

GERMANIUM DIODES

for that Crystal Set.
5/6. Post Free.

511A C.R. TUBES

These 12in tubes have been recommended for TV use in "Radio World." Uses same sockets as VCR97.

£4/17/6 **F.O.R.**

Please address all correspondence to 332 Parramatta Road, Stanmore, N.S.W.

METROPOLITAN RADIO SUPPLIES

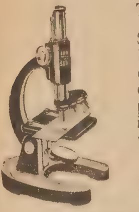
332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE LM7392
540 KING STREET, ST. PETERS, N.S.W. PHONE LA6087

FOR TECHNICAL EQUIPMENT AND USEFUL GADGETS. MAIL ORDERS TO BOX 5234, ELIZABETH ST. POST OFFICE.

WALTHAM
TRADING CO.
229 Elizabeth St., Melbourne

SYDNEY: 96 Oxf
St. Mail Orde
to Box 22, Oxf
St. Post Offic
ADELAIDE: 24
Rundle St. M
Orders to tha
Address.

IDEAL MICROSCOPES



The Student's Friend

Single Eye Turret Model. 300 Magnification. Provides not only many hours of pleasure, but fascinating discoveries for the whole family.

PRICE: 79/6.

Packing and postage, 3/6; interstate, 4/6.

MAGNIFYING GLASSES
3in lens. 3 7/8in handle. **PRICE: 25/**
2½in. lens. 3½in. handle. **PRICE: 17/6**
Packing and postage, 2/6.

VALUE IN VALVES

Special Prices for Quantities

1D8	**8/11**	7C7	**1/11**
1Q5	**8/11**	7W7	**2/6**
1J6	**7/6**	807	**19/6**
1P5	**8/11**	811A	**19/6**
2V3	**15/-**	829B	**£5**
2X2	**12/6**	954	**3/11**
6A6	**10/6**	955	**3/11**
6A8	**12/6**	705A	**15/-**
6AC7	**2/9**	12SR7	**7/11**
6AJ5	**9/6**	1626	**5/-**
6C8	**7/6**	1629	**7/6**
6F8	**12/6**	AV11	**5/-**
6H6G	**1/6**	CV.66	**4/6**
6J5	**2/11**	DQ2	**17/6**
6J7	**7/11**	EL3N	**11/6**
6K7	**3/11**	EF.50	**2/9**
6K8	**9/6**	VR53/EF39	**3/6**
6L7	**12/6**	VR.65A	**2/6**
6N7	**9/6**	VR.78	**7/6**
6SH7	**2/11**	VR.100	**4/6**
6SJ7	**12/6**	VR 150	**15/-**
6SL7	**12/6**	**Cathode Ray**	
6U7	**6/9**	**Tubes:**	
6X5	**9/6**	VCR112	**50/-**
6Y6	**12/6**	3API	**60/-**
7A6	**5/-**	EF50 Sockets	**3/6**
7A8	**5/-**	**Please add**	
7C5	**5/-**	**Cartage.**	

DURAL TUBING

VERY USEFUL

For TV aerials, tent poles, etc. Strong metal tubing in these sizes:

Diameter	Gauge	Price per foot
½in	20	**1/**
7/8in.	20	**1/6**
9/16in.	22	**1/3**
¼in.	16	**9d**
5/16in.	16	**1/**
7/16in.	16	**1/**
¾in.	16	**1/9**
⅜in.	17	**1/**
9/16in.	17	**1/6**
7/16in.	18	**1/**
¾in.	18	**1/3**
5/8in.	16	**1/3**
1in.	20	**1/9**
15/16in.	20	**1/6**

(No Mail Order for Dural Tubing.)

Battery Chargers, dual voltage, 6 and 12 v. Charges at rate of 6 amps. **PRICE: £9/15/.**
Packing and delivery to railhead, 5/.
Headphones, Low Impedance, **17/6.**
Packing and postage, 3/6.

• RANGE RECEIVER •

A Receiver with two inputs—one a straight receiver, 38 megacycles, containing 954,6G8, and 6J7 valves. The other input is a standard super heterodyne, IF.1600 Kcs. supplied with 33.3 and 33.8 megacycles crystals. It contains the following valves: 6U7 (3), 6A8 (1), 6G8 (2). High Tension Input, 250 v. DC. 60 MA. Model wired for 12-v. DC has switching motor for 6 crystal positions.

Model wired for 24 v. DC has relay switch with 2 crystal positions.

IN WORKING ORDER. PRICE: £10
(Available at Melbourne Branch only)

FINE TELESCOPES

DRAW TELESCOPES: 50 x 50. Has adjustable prismatic eyepiece, blued lens. Complete with 8in. Tripod.

PRICE: £19/19/

50 x 40 (same features as above)
PRICE: £17/17/. EIKOW x 20, £5/5/.

BRASS DRAW TELESCOPES. Ex-Army. Two lenses, 1-10x. 1-15x **£15**

HEAVY MOUNTING TELESCOPES, ex-Army. 2 lenses, 10 and 15x, **£17/10/.** EIKOW 'SCOPE, 30 x 40, with tripod, **£10/19/6.**
Packing and postage, 5/-; interstate, 6/6

THE FAMOUS SANWA MULTIMETERS

Model 305G, 20,0000 ohms per volt.
AC and DC .. .. .. **PRICE: £15/15/**
Model SP5. 2,000 ohms per volt.
AC and DC .. .. .. **PRICE: £7/10/**
Packing and registered postage 6/.

Sanwa Micro Amp. Meters
0-100, **50/**; 0-50, **70/ and 75/.**
0.1, Ma., 1in. square, **37/6.**
Packing and postage, 3/6.

Air Force Eight-Day Dashboard Clocks

Precision instrument. Ideal for cars.
Dial, 2 inches by 2 inches.
PRICE: £7/10/
Packing and postage, 3/6; interstate, 5/

No. 3 Carbon Hand Microphones, **12/6**
Packing and postage (all States), 3/6.

MORSE BUZZER SETS

Complete with headphones, and a
BARGAIN FOR 32/6.
Packing and postage, 11/6.
BATTERIES, 1.5 volt, suitable
Morse Buzzer Sets. **Price 7/ per** p

Slide Rules—Four Type

Precision-built, Scientific Instrumer
No. 605: 7½in. long, 1½in. wide, c
board case .. .. **55/-** e
No. 450: 6in x 1in, fitted with ma
fying cursor. In leather pocket c
PRICE .. .. **50/-** e
No. 403: 4½in x 1in, fitted with ma
fying cursor. In leather pocket c
PRICE .. .. **39/6** e
No. 28 (Circular type): Diameter,
In plastic cover. **PRICE: 25/** e
Packing and postage, 2/.
These Slide Rules are complete with
Instruction Manual.

VERNIER DIALS FOR NO. 11 TRANSCEIVERS.

Price: **17/6.** Packing and postage (all States), 5/.

HERE FOR RECTIFIERS

6 v. 2 amp., **24/6**
6 v .4 amj. **45/**
6 v. 5 amp., **50/**
6 v. 10 amp., **79/6**
12 v. 2 amp., **32/6**
12 v. 3 amp., **45/**
12-15 v. 6 amp., **79/6**

12 v. 3 amp., or
6 v. 4.5 amp., **45/**

Packing and postage, 5/

STUDENTS' DRAWING SE

By Becon; 10 pieces, including sp
and firm-joint compasses and divid
etc. **PRICE** 3
Another BECON Set, super qua
with 12 pieces. **PRICE:** 7
Packing and postage, 3/6

THE ASTRO COMPASS

With slight modification can be m
into an accurate DUMPY LEVEL.
ditional requirements are a light tri
and telescopic sight. Astro, a preci
instrument, has declination scale
micrometer adjustments, azimuth ci
cross levels, and adjustable turnta
Fully calibrated. **PRICE: 5**
Packing and postage, 11/.

We have **PRISMATIC TELESCO
SIGHTS** which can be adapted for
as a sighting tube with the Astro C
pass. **PRICE: 50/ each.**

Crystal Set Cases; Bakelite, in attrac
colours, **7/6.** Call and choose. G
manium Diodes, for Crystal Sets. C
3/6 (and post free).

T'S BUY AN ARGUMENT

(Continued from Page 99)

are better than or worse than
. . ."

had one or two examples of
d-load technique in our labo-
d have checked them in a
ind of way without, however,
own to the exhaustive detail
uld be necessary to define com-
eir performance.

en then, only half an answer
available.

nt results can be obtained by
veral circuit techniques but the
result depends as much as any-
the output transformer. Is it
example of the maker's art for
of amplifier? Could equivalent
obtained from a simpler trans-
sing another technique? Are the
esults superb, only because an
ic transformer has been used?

important for the present, I
the question "does it really

various circuit techniques, am-
n be made so good these days
are not limiting factors to the
lt. Records, pickups, speakers
les are all likely to be more
t in their contribution to total

little wonder then, that hi-fi
ts aren't too easily "het up" by
particular circuit arrangement.
tion another type of pickup or
nd watch their interest quicken.

And what of the synchrodyne receiver? We don't have any strong feelings ourselves, never having tried the circuit in practice. It gets back to what we said last month about time to do all these things and the tendency to skip them unless there is an apparent urgency.

Unfortunately, it's a bit hard to get a sense of urgency about the synchrodyne. The circuit idea is as old as the proverbial hills but it's never been exploited to my knowledge. I've seen one or two "how to make" articles in overseas mags. but I can't recall ever having seen or heard the finished product. In fact, I can't recall having met anyone who has.

It's a kind of technical will 'o' the wisp.

Well then, let's toss the question into the arena. Who amongst our readers has actually built or operated or even seen a synchrodyne receiver in years sufficiently recent for the memory not to have been garnished by its remoteness? Was it shatteringly good, or fairly good or just ordinary or disappointing? Was it simple to get going or a real headache?

We'd like to know.

Meanwhile, another correspondent, H.A.P. isn't happy about the conditions under which hi-fi equipment is being demonstrated.

I wonder how many other readers have similar complaints?

OME IMPROVEMENTS TO SYNCH. SEPARATORS

(Continued from Page 83)

ing the stage, it is important
22K resistor, be mounted close
video amplifier valve, both to
capacitive loading of the video
to avoid carrying high inten-
o signals throughout the chas-
was provided for in the ori-
outs.

ad feeding the input grid should
ct to the socket pin and not
e to the plate or other com-
Purpose of this is to reduce
e feed-through of video infor-
to the plate and second grid
ce to the synch. output circuit
line oscillator.

slight feed-through is inevitable
n of wiring capacitance, socket
ce (it should ideally be a wafer
also the direct grid-plate cap-
within the valve itself.

ideo content can be seen on an
pe but tests have shown that,
inary wiring care, its level is
elow the pulse information that
o measurable effect on either
. On a comparative basis, the
eo ratio is better than many
ial receivers.

ng the matter of video content,
of general interest, we rewired
et to use a 6U8 triode pentode.
tants were as for the 12AU7,
addition of a 1-meg. resistor
plus to feed the screen, a 0.1
ed to earth and a 0.1mfd. by-

the pentode section in this way

for video input and clipping and the triode as an amplifier, the video content appeared to be somewhat less and the pulse amplitude somewhat greater than for the 12AU7.

Neither factor appeared to be important to the end result, however, the suggestion, on the contrary, being that the pulse input to the line circuit at least could be above optimum, if increased beyond that available from the twin triode.

The adaptability of the circuit to a triode-pentode is interesting, nevertheless, and may warrent closer examination should the occasion arise.

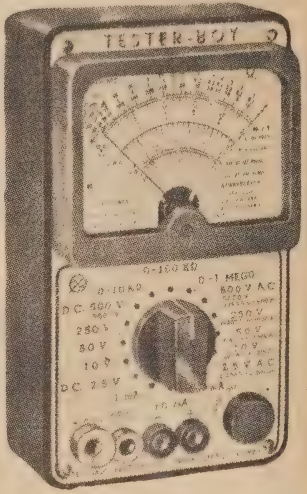
SUPERCONDUCTIVITY

(Continued from Page 9)

Cooling apparatus for maintaining materials at these temperatures by the use of cold helium gas or liquid hydrogen is commercially available. We can now consider employing superconductors for sensitive electrical measuring instruments, switches, computer memory devices, resonating chambers in radio equipment and perhaps even transmission lines, say from the antenna to the amplifier of a radio telescope. In all these devices a superconductor would make it possible to handle extremely tiny currents or signals without any loss of their energy.

"TESTER BOY"

Complete with
Leather Case,
Test Leads
and Batteries



Specifications:

Clear scale 3in x 2in.

Overall dimensions in carrying case, 4½in x 6½in x 2½in.

1,000 o.p.v. highly damped movement.

Volts: AC & DC.
6 ranges to 5,000 v.

Resistance: 3 ranges to 1 megohm.

Current: 3 ranges to 500 ma.

Output: 2 ranges −20 to + 56 db.

Price £7/10/-

Post — N.S.W. 2/3, Q'ld., Vic., Tas. 3/8: S.A., W.A., N.T.. 5/-.

RADIO HOUSE

PTY. LTD. 296 PITT STREET
PTY. LTD. 6 ROYAL ARCADE
PTY. LTD. 760 GEORGE ST.

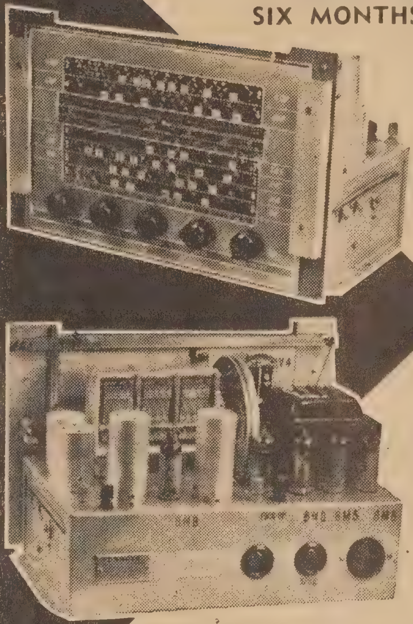
before purchasing your radio see ou

Hi-Fidelit

RANGE

and compare these NEW feature

ALL CHASSIS
GUARANTEED FOR
A PERIOD OF
SIX MONTHS



NEW:

Ultramodern circuit using nine high gain valves including "magic ey indicator. Permatuned iron cored coils and intermediates giving excel state reception and a short wave range of 12,000 miles. All valves the new Mullard nine pin Innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplif with separate bass and treble controls giving plus or — 15 db. boc at 50 cycles L.F. and 10,000 H.F., combined with push-pull ou inverse feed-back gives you really high fidelity reproduction from y or favourite recordings

NEW:

Dual Speaker combination, using a heavy duty woofer (12in M.S.P. Jen special) with matching 6in tweeter and cross-over network giving a response of 46 to 13,000 cycles. Speakers are mounted coaxially ma one 11in mounting hole necessary.
If required the new Magnavox high-fidelity twin coned speaker can be

NEW:

Large calibrated edge-lit dial in plate glass (11in x 7in) with main s each State in prominent type. Dial fitted with counterweight drive, givi tuning. Indicator lights are fitted showing which band is in operati can be supplied in cream, black or brown with matching knobs and escu suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple tive even on interstate, overseas and country stations.
All chassis are wired for the fitting of an F.M. tuner or tape record plug being provided on back of chassis, also pick-up terminals and gramo motor.
Power switch is fitted to volume control, radiogram switch, combined change switch. Audio end of set can be used with TV receiver if req

A NINE VALVE HIGH-FIDELIT RADIOGRAM CHASSIS

Nine and ten valve chassis incorporate the Mullard 5-10 AMPLIFIER CIRCUIT Frequency response 40-13,000 cycles. Max. output 10 watts.

£41/1
F.O.R.

A NEW 10 VALVE DUAL WAVE RADIOGRAM CHASSIS

WITH BASS AND TREBLE BOOST

The ideal chassis for those difficult locations where reception is doubtful. Specifications are nine valve unit, but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

£44/1
F.O.R

NEW SEVEN-VALVE HI-FI CHASSIS

This new compact dual wave seven-valve chassis uses the same tuner circuit as our 9-valve unit with the Mullard tone-control circuit giving separate bass and treble controls. Push-pull output using two of the new 6BM8 dual purpose output valves and heavy duty M.S.P. speaker **£31/15/-** F.O.R. PACKING 10/ EXTRA.

Also available with Magnavox 12W.R. Hi-Fi speaker and Ferguson output transformer at £4/15/- extra.

Write for full specificatio

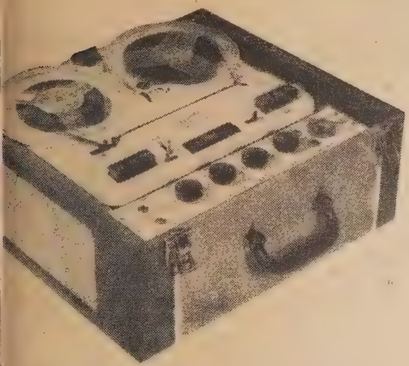
ALL 4 SPEED RECORD CHANGERS AND PLAYERS STOCKED

Classic Radio

245 PARRAMATTA ROAD HABERFIELD N.S.W PHONE UA2145

ıying a Tape Recorder?

t see and hear the new Hi-Fi Recorder by Classic incorporating the Collaro Mark III Transcription deck. The only deck with ALL these features.



COMPLETE UNIT IS SUPPLIED IN
'RACTIVE AND DURABLE TWO-
IE PLASTIC COVERED CASE COMPLETE
WITH ACOS MICROPHONE

ıix-valve amplifier incorporates the latest
rd" tape recorder circuit equalised to C.C.R.
rds giving perfect reproduction from recorded
Record, monitoring and outlet to power am-
Extension speaker outlet and "magic eye"
ndicator. Amplifier is completely shielded and
with perspex dress plate to match deck.

- **HIGH FIDELITY**
Heads are double coil wound and will reproduce up to 12,000 c.p.s. at 7½ inches per second. Azimuth adjustments on both impedance "record" and "playback" heads. Output of heads is approximately 5 milli-volts at 1 Kc at 7½ inches per second.
- **INSTANTLY REVERSIBLE**
Instantaneous changes can be made from one track to the other. Fast re-wind in either direction.
- **CONSTANT TAPE TENSION**
A special Collaro device ensures a constant tension on the tape on the take-up spool as it leaves the capstan.
- **FULLY MECHANICAL**
No solenoids are used in the construction of this Transcriptor. The braking is entirely mechanical.
- **FINISH**
Cream Polystrene cover plate with maroon controls.
- **THREE SPEEDS**
3¾, 7½, and 15 inches per second.
- **FOUR HEADS**
Two "Record/Play-back" and two "Erase" heads are sited on two different levels and head wear thus halves for any given length of track.
- **TWIN TRACK OPERATION**
One pair of heads for each track. Both top and bottom tracks can be recorded or played back without removing tape.
- **PAUSE CONTROL**
This has the effect of stopping the transit of the tape past the "Record/Play-back" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected position. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURING & CALIBRATING DEVICE**
The three digit counter makes the location of any recorded passage the simplest of operations.
- **TRANSCRIPTION TECHNIQUE**
A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter to less than 0.15 of 1.0 per cent.
- **TWO MOTORS**
Each dynamically balanced motor does only one job at a time. Motors never act against each other and are of low wattage input with consequent reduction in heat and wear.

MPLETE RECORDER WITH MIKE—80 GNS. f.o.r.

DECK WITH AMPLIFIER, POWER SUPPLY & 6in x 9in SPEAKER 70 GNS.

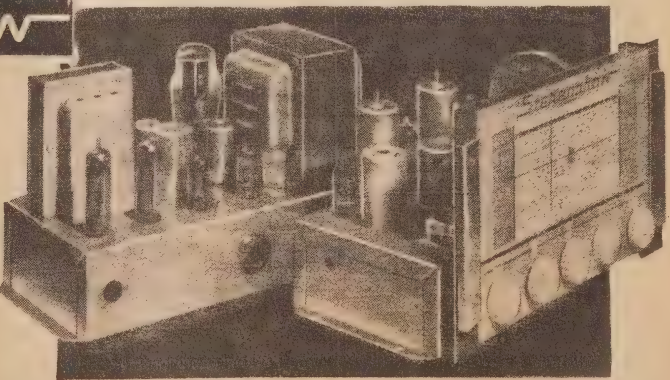
---

tereophon

IVING SOUND—

mpact 11-Valve
rade Radio-
in two chassis
ing a variable
with Tuner
input preampli-
nd Tone Con-
n one unit and
Vatt Ultra-linear
fier. Ideally
for use with
rade pick-ups
peakers.

65 GNS.
F.O.R.



Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145

SURPLUS STORES, 512 ELIZABETH ST
MELBOURNE

Bargains in Ex-Army and Ex-Air Force Articles.

Ideal for shooting
SIGNALLING LAMPS

12-VOLT Long Beam Army Spotlights. Can be adapted for fitting to cars, trucks, boats, etc. Twin handles; trigger switch. With spare globe.

PRICE 39/6
Packing and postage, 6/; interstate, 8/6

Leather Flying Helmets
ex-R:A.A.F. Takes Standard Gosport Tube.
PRICE: 50/. GOSPORT TUBES, **50/.**
Packing and postage, 3/6.

SAFETY BELTS
As used in Aircraft

Highly recommended for car trials. Quick-release catch. Complete with body harness. **PRICE 19/6 EACH.**
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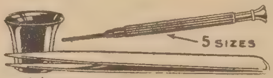
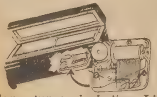
Watchmakers' Tweezers, **5/6** and **6/6.**
Watchmakers' Eyeglasses, **6/6.**
Extra Strong Double Lens Eyeglasses, **15/.**



Screwdrivers, set of five 13/9
Packing and postage (all States) 3/.

Make your own Music Boxes with these Swiss Music Units.



30/-
EACH

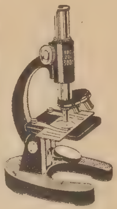
Many tunes, including Lili Marlene Harry Lime Theme, Wedding March, Merry Widow, Happy Birthday, Parade of the Wooden Soldiers, Silent Night, Swedish Rhapsody, Annie Laurie, How Dry We Are, Roll Out The Barrel, Who's Afraid Of The Big Bad Wolf.
Packing and postage, 3/; interstate, 4/6

LOOK! VERY SPECIAL
Magnifying glasses, 8 mags., **8/6;** 10 mags., **12/6.** Tapped Transformers, 6, 12, 18, and 24 volts, 3 amps, **45/-.** Genuine Army Telescopic Sights, **£9/19/6.** American Oxywelding Torches, **£5/10/-.** 24 volt, 1,500 watt Generators, **£12/10/-.** Ball-bearing Step-down Gear Box, 50/1 reduction, **39/6.** **Steel Masons' Squares,** 24 x 12, **14/6.** 14mm Spark Plugs, **4/** each. Long-nose Pliers (English), **9/6.** Spark Plugs (7-8in), suit most old cars and tractors, **2/6.** Flying Goggles, complete with spare lenses, **17/6.** German Jack Planes, **25/-.**
(Please add Postage.)

Look Ahead! Telescopes!

50 x 50 magnification .. .. .. **£19/19/.**
40 x 50 magnification .. .. .. **£17/17/.**
20 magnification, in pigskin carrying case; pocket size, very handy **£5/5/.**
30 magnification, with tripod **£10/19/6**
Packing and postage, 7/6; interstate 10/.

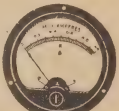
MICROSCOPES
Wonderful Value



A splendid gift for any person — either young or grown up. This instrument is much more than a toy; it can provide many hours of study. 300 magnification.

PRICE: 79/6 EACH.
Packing and postage, 3/6; interstate, 4/6.

Never before at such low prices!
METERS
British-Made



0-1 Milliamp Meters, 2¼in	50/
0-5amp Meters, AC-DC, 2¼in dial ..	45/
50-0-50 amps ..	50/
0-1 Miniature Milliamp Meter, 1 1/8in.	37/6
0-14 amps, AC, DC, 4½in dial.	65/
0-25 amps, DC, 3in	29/6
0-200 amps, DC	£4/10/
20-0-20 amps, DC..	37/6
0-200 amps, AC-DC, 3½in. ..	£4/19/6
0-150 milliamps, DC, 2¼in	27/6
0-20 volts, DC, 2¼in.	22/6
0-30 volts	30/
0-50 micro amps, 1 7/8in.	70/
0-100 micro amp meters, 1½in ..	50/
0-30 V, AC, DC, 2¼in	45/
0-300 Volts; AC-DC, 4½in dial,	£6/10/

Packing and Postage, 3/6; interstate, 5/.

Brand New English Micrometers
0 to 1, **18/6;** 1 to 2, **22/6.**
Packing and postage, 3/6.

STUDENT'S DRAWING SETS
Splendid quality, 9 pieces **33/9**
Others: 6 pieces, **40/6;** 5 pieces, **16/11.**
In velvet-lined cases.
Packing and Postage, 3/6.

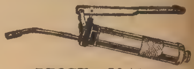
Please Mention Your Sta in Your Mail Order.

WHIP AERIALS
AMERICAN SCREW TYPE-
3-PIECE, SEAMLESS
PRICE: 39/6 PER SET
ALSO, TANK, WHIP AERIAL

In flexible steel. Three Sections (12ft), **22/6**
2 sections (8ft), **15/ per set**
Packing and freight, 5/

THESE ARE JUST THE THING FISHING RODS AND CAR AERI

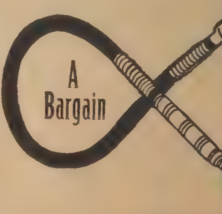
Grease Guns, Lever Ty
BRAND NEW



PRICE: 53/6
Ideal for all types of TRUCK TRACTORS or CARS. Pressure, 7,5
Packing and postage, 5/; interstate,

PROTECTION AGAINST GLA
SUN GLASSES
R.A.A.F. Type .. .. **Price:**
De-Luxe Type .. ..
Packing and postage, 2/6

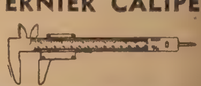
UNIVERSAL FLEXIBL SHAFT
44in. log; ¼in. chuck.



£4/1
EACI

Packing and postage, 5/; interstate,
Grinding and Engraving Burrs.
Packet of six, 2/
Polishing Brushes, **6d each**
For hobbyists, die-makers, home ha men, garagemen, engineers, plas workers.

VERNIER CALIPERS



MEASURED IN INCHES AND M
Complete with Depth Gauge.
PRICE: 12/6
Packing and postage, 2/

NSWERS TO CORRESPONDENTS

.. **(Coburg, Vic.)** sends in some ideas tor ıder Built It" page.

lany thanks for your contribution. We ys on the lookout for interesting items page.

. **(Charters Towers)** comments on our re- cle and the heading "Death Rides The ssis."

here has been a lot of comment about :le, nearly all of it favourable. Your s have also been noted. We cannot a more fiendish device than a transform- antel receiver fitted with earphones and st you have nothing to do with the idea. ılf-wave or bridge rectification is possible, er being simpler in many cases. Heat- usually connected in series and operated a dropping resistor.

(Nowra) sends in the circuit of a 3- receiver which he has built.

Aany thanks for the circuit, which has ssed on to our staff member handling ader Built It" page. Until he has ex- it in detail, it would not be possible ıent further.

. **(Abbotsford, Vic.)** was interested in our planation as to why some people hear the rom a line output transformer and others He says that his own son can always ı the family TV set is switched on, even remote part of the house. It is im- to trick him by keeping the volume low he hears the 15,625cps line frequency

'our problem is being repeated in many ınd for the same reason — young ears high frequency sounds much better than nes. Receiver manufacturers are well f the difficulty but it is not easy to pre- ne residual mechanical movement in a vhich is handling as much power as the out transformer.

a much more urgent problem in Britain. ıe frequency is around 10Kc and therefore he hearing range of most people. In e, the trouble may be so bad as possibly assed as fault. Your only course would oproach a reliable service organisation or, till, the manufacturer's own service de-

. **(Dalby, Qld.)** sends in an idea for the Built It" page.

Thank you for your letter. The hint ppear to be quite a useful one and has ıt into the appropriate file for future

(No address) encloses a 2/ stamp and out a certain back number.

We would like to help you but though tter is signed, there is no address ap-

:D. (No address) is another reader who query but does not include his address swer, as originally phrased for reply by as follows:

Calibration of signal strength meters for communication receivers is usually a ıt vague business and in practice many s are satisfied to have an arbitrary scale plement the scale with an aural judgment. R:R.L. Handbook lists the signal strength follows:

-Faint signals, barely perceptible.
-Very weak signals.
-Weak signals.
-Fair signals.
S5—Fairly good signals.
S6—Good signals.
S7—Moderately strong signals.
S8—Strong signals.
S9—Extremely strong signals.

However, if amateur stations, in giving reports to one another were to use this scale literally, there would be many S3, S4 and S5 reports and few S9 reports. In practice reports tend to be up around the 8 and 9 mark.

If we remember correctly, there was an attempt to make a more rigid definition of signals strength measurements by making S1 equal to 1 microvolt and each S point 6db above the other. In order to follow this idea you would need a calibrated signal generator.

About the only way you could obtain a factory prepared scale would be to supply a rough version to the manufacturers after the signal generator calibration. However, the cost would, in most cases be all out of proportion to the worth of the scale and the best plan may be to prepare one by hand with the aid of a lettering guide.

M.R.R. (Sencliff, S.A.) would like to see some work on UHF converters. He also has a question about sidebands.

A. We would like to see one too but have not been able to tackle one recently. To obtain the answer to your sideband question would really need resort to the maths of the matter. Various resultants, can come from modulation and demodulation but, if some of them cancel, they disappear as significant quantities. Fortunately for the AM system, the output of an ideal detector contains only the original modulating frequencies, not their harmonics.

J.B. (Wollongong, N.S.W.) encloses the circuit of a small one-valve set from an American magazine.

A. It is a pleasure to see one of these circuits which is conventional, not some superregenerative or transmitting device calculated to drive neighbours or the authorities to distraction. The circuit is quite straightforward and would work as well here as in the U.S.

G.D.M. (Blackwood, S.A.) says he would like to see a modernised version of the audio generator described in the August, 1945 issue.

A. You must have missed the September, 1955 issue in which a modernised version of the instrument appeared. It is capable of much better results than the original, though it is physically smaller. Many thanks for your contribution to the "Reader Built It" page. The most likely criticism of your mixer would be in regard to possible treble loss due to Miller effect in the mixer triode. Hum might also be evident from the active cathode circuits if the valves are in any way suspect.

B.M. (East Malvern, Vic.) wants to know the advantages of a doublet aerial over the more usual type.

A Used as a general purpose aerial, a doublet's only advantage is that there is much less signal pickup on the lead-in than on an ordinary single-wire lead-in. This may be helpful if the receiver is suffering from interference coming from the power mains or some device very close to it. By keeping the aerial away from the source of noise and using a twin lead-in wire, the interference effect can be kept to a minimum. To operate properly, a doublet must have a twin balanced lead-in connected to the two ends of the aerial primary winding. If the two lead-in wires are connected together or if one of them is simply connected to the chassis earth terminal, the system loses any advantage it might have. Over and above the problem of purely local noise, the doublet does not necessarily give any better signal pickup than a conventional aerial and lead-in. It certainly does not confer any advantage in relation to distant interference or atmospheric static. Amateur stations use doublet style aerials but under different conditions, where they are proportioned so as to be naturally resonant on the relatively narrow amateur bands. We can supply details of a general purpose all-wave doublet through our 2/ query service.

P.E. (Indooroopilly, Qld.) asks us about some morse buzzer sets advertised recently.

A. We cannot offer you any technical advice about these items or, in fact, many others which are appearing in advertisements. If advice is required, it would have to be sought from the advertiser who may or may not understand the technicalities of the units he is selling. In some cases we have had occasion to use or test advertised products but this would be incidental to our normal technical activities. As far as we know, the buzzers would have to be interconnected by wire circuits. There is no thought of radio transmission involved. In fact, if there were, the items would be classed as transmitters and some kind of licence would be needed to operate them.

P.T.M. (Ryde, N.S.W.) has a lot of questions to ask about technical terms.

A. Your letter involves too much to answer in these columns but it provides excellent material for our "Answer Tom" feature. You can expect to see the queries discussed within the next couple of months.

L.S. (Bentleigh, Vic.) is interested in the galvanomagnetic amplifier mentioned in the article "Survey of Tubeless amplifiers."

A. This article, as indicated, was reprinted from an overseas source and we have no information on the constructional aspects of any of the equipment. Short of making a special study of the subjects, we could not answer your questions. These "survey" articles are intended to open up lines of thought but we must leave it to individual readers to follow up any aspect which particularly interests them.

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

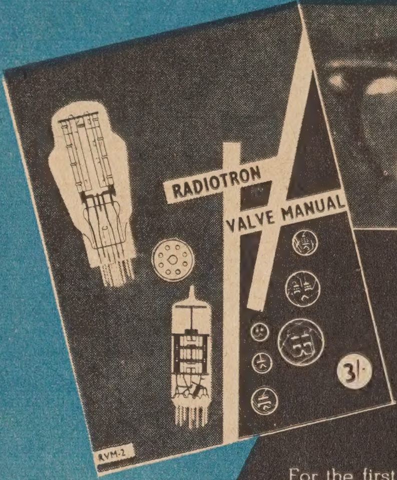
To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

WA
RONETTE
:ROPHONES & ACCESSORIES
Type HM7
£6/12/6
Hand or stand microphone. filter-cell. obust diecast housing, attractively finished
NICHOLSONS LTD.
BARRACK ST., PERTH
and leading wholesalers

You will See the Difference



Servicemen, technicians and salesmen alike will see the difference the Radiotron Valve Manual makes to their valve characteristic problems.

For the first time under one cover the Amalgamated Wireless Valve Company presents the following complete and comprehensive technical data:—

Receiving Valve Classification Charts • Base Charts • Valve Data • Picture Tube Data Photocell Data • Semi-conductor Diode Data Transistor Data.

This information is tabulated in numerical and alphabetical order, and lists, for each type, principal functions heater voltage, typical operation and base connections.

◆

Covered in heavy art board for durability and priced at 3/- including postage, the Radiotron Valve Manual (RVM-2) is available on request from A.W.V.

AWV

Published by

AMALGAMATED WIRELESS VALVE CO. PTY. LTD.

47 YORK STREET, SYDNEY

SISTOR AMPLIFIER

:ontinued from page 39)

ncluded in the chassis blueprint uld be available ready made h the chassis.

he switch hook proper we an assembly of contacts which mounted against the inside front se and which could be operated ertical movement of the hand-

on determined that the require- ld be satisfied by a standard re- ement, and a check with the urer confirmed that he would g to supply relays less the coil the trade.

elay is a 600 type, and in the he transistor telephone amplifier, y have one set of contacts, which ally open.

00-type relay is rather smaller better-known type 3000 and has ilable through disposals stocks. ly that many readers will have ypes on hand. To adapt it for ose the coil should be removed shorter arm of the yoke, which y held the coil, cut off. This e longer arm of the yoke hold- ontact assemblies and the arma mount flat against the inside the case.

t must now be cut in the case v the armature to protrude the cutout in the rear of the d bracket. The position of this hould be determined with care. unit, the top of the slot was m the top of the case (outside). deep and ⅝in wide.

e cutting the slot, the leather- vering should be cut with a azor blade on a horizontal ng the centre of the proposed hort vertical cuts at each end ow be made, and this will allow all pieces of the covering to d back while the slot is made. st easily cut out with a coping l finished off with a file. The te is then glued back into place surplus turned into the slot.

se of the angle of the case front, ature does not protrude through t at quite the angle required, found it necessary to make a modification. This takes the f an extension to the armature g of a piece of sheetmetal ap- tely ¼in x ½in which is fastened

VE-IN THEATRES

:ontinued from page 25)

ch comments Vido-Sound people at they have not experienced any ickup of any kind and expect That at Dover the wire loops the signal are fastened to the le of the concrete upper deck, t in nontheatrical applications have been picked up quite suc- from a submerged submarine.

Sound not only expects many ive-ins to adopt its system, but its successful use in many other ons—public-address systems at fairs, carnivals and travelling for two-way intercoms; possibly r ground to air communications l not interfere with any radio ication.

THE R., TV & H. CROSSWORD No. 48

1		2		3			4	■	■	■	■	■
	■		■		■	■	5		6			7
8						9		■		■	■	
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	■	12										
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16			17		18		■	19			■	
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22					■	23		24	25	■	26	■
27			■	■	28					29		■
30				31				■	32			
	■	■	■	33			■	■	34			■
	■	35					■	36				

ACROSS

1. Transferring energy from one circuit to another.
5. Obsolete name for triode valve.
8. Continuous oscillations.
10. To sever.
12. A clock worked from AC.
13. Floor protector
15. Tear.
16. Paper for drying ink.
19. Greek letter.
20. To dress with feathers —as a bird.
22. Summoned.
23. Small area of ground.
27. Single.
28. Type of cable.
30. Australian bushranger.
32. A malarial fever.
33. Place protected from the wind.
34. To decay.
35. Blows.
36. Leaves of a book.

DOWN

1. Unit of flow of current.
2. Without distortion.
3. Describes transformer cores.
4. A short-pointed chisel.
6. A piece of equipment for long distance reception (two words).
7. Sounds.
9. An anaesthetic.
10. Part of a transformer.
11. A translucent or transparent gem.
14. Pertaining to Alps.
17. Golf ball support.
18. Half an em.
21. To engage in sport.
22. Fruits of the Pine.
23. Part of a magnet (pl.).
24. Beast of burden.
25. Crown-like head ornament.
26. A musical instrument.
28. A musical character.
29. Highly excited.
31. A mischievous fairy.

Solution and further crossword next month

to the back of the armature.

By punching out the small copper slug in the armature, a hole is provided by which this attachment can be made. A rivet is the best means of fastening, plus some solder for added stability.

The protruding portion of the attachment may now be bent slightly downwards so that it presents the correct angle to the receiver case. In our unit we found it best to space the relay away from the inside front of the case by 3/16in. A strip of 3/16in ply provided the necessary spacing.

The relay was mounted to the case by means of two ⅛in machine screws, appropriate holes having been drilled and tapped in the yoke.

With the relay working correctly, the remaining units—speaker, amplifier, batteries, etc.—may be fitted into the case and the device tested. A handset hung in position should produce the normal dial tone in the speaker, and dialling one's own number will produce the engaged signal. This should be quite strong. If feed-back occurs or appears likely, the gain should be reduced until the system is stable.

And that's about all there is to it. In any office, such a device will prove a marvellous work aid. It should pay for itself in a few weeks in the time it saves by releasing personnel who would otherwise be chained to the phone—wastefully—for many hours per week.

R	U	T	H	E	R	F	O	R	D	■	T	■
E	■	A	I	R	■	O	■	■	I	R	O	N
S	U	P	P	R	E	S	S	O	R	■	R	■
I	■	S	P	A	R	T	A	■	E	T	C	H
D	■	■	O	N	S	E	T	■	C	■	H	■
U	■	A	D	D	E	R	■	S	T	E	E	R
A	V	E	R	■	■	■	G	A	I	N	S	■
L	■	R	O	T	O	R	■	T	O	T	■	■
■	■	A	M	I	■	■	T	U	N	E	R	S
W	A	T	E	R	■	C	U	R	A	R	E	■
A	■	I	■	A	E	R	I	A	L	■	L	■
T	■	O	■	D	■	Y	■	T	■	■	A	■
T	E	N	D	E	R	■	H	E	A	V	Y	■

Last month's solution

WANTED TO BUY, SELL OR EXCHANGE

SELL: Garrard 3-speed player in cabinet, £8 H.G.P. 40 pickup, £8/10/. Rola 120 De luxe, £3. **Brisbane, ring M1314.**

SELL: Real bargain, £100 buys, English M.S.S. Tape Recorder, dual-speed, three motors, fast forward auto-stop complete with microphone, separate loudspeaker, instructions and circuits. **Phone WF3233, Melbourne, LX2875, Sydney.**

SELL: Genemotors la V input, 275 V. at 110 ma, and 500 V at ma dual output, several, **37/6** each, add postage if required. Also 50 Microamp meter, 3in Elliott **90/-**; and 1 ma meter rectifier, W'house, **10/-, C. Luckman, 2 Milton St., Canterbury, Vic. WF8653.**

SELL: Wobbulator for sale. **C/- Lot 4 Seaview Ave., Curl Curl, N.S.W. XF3630.**

FREE: Large Junk Box to buyer complete 60-watt Ham Rig. 10-tube R.C.A. Recvr. V.F.O Freq. Meter/Monitor. Consider exchange for camera equip. or £100. VK2PT, **Stephenson, 10 Sketchley Pde., New Lambton, 2N. LU3483.**

SELL: Hallcrafters SX28 communication receiver 540 kc-43 mcs. Good condition, £90. **J. G. MacIver, 21 Hurd Tce., Morningside, E.1., Brisbane.**

SELL: A.W.A.—A13 transmitter, 2-20 mcs. 500 watts, as new, **£40.** U.S. twin modulators type mdl./F.R. output 300 watts each. Good condition, **£30. J. G. MacIver, 21 Hurd Tce., Morningside, E.1., Brisbane.**

SELL: Portable 18 valve F.M. transceivers. 48-52 mcs, including headset and mic., handset, 3 whip aerials, set of spare valves. Good condition, **£15. J. G. MacIver, 21 Hurd Tce., Morningside, E.1., Brisbane.**

FOR SALE: Wired 6in TV as per R.T.V. and H. circuit in metal cabinet. All brand new, **£50.** Now built 17in set. Also I.F. strip, Q.-Plus coils, plus valves, **£7/10/-.** 5 P.B.1.'s, Wobbulator, unit and parts. **1 Mernda St., Sunshine, Vic. MM2918.**

FOR SALE: Castings and designs for Marine, Locomotive and general engineering students. Catalogue **5/6. Bolton, 72 King St., Sydney.**

FOR SALE: Communication Receiver type R107. 1.2-17.5 m/cs, ac /dc, perfect condition, Handbook, **£70** or near offer. **26 Embankment Grove, Chelsea, Vic.**

FOR SALE: Old established Radio business in Lismore. Good Agencies, with large sales potential. **Particulars, Box 389, P.O., Lismore, N.S.W.**

FOR SALE: B.J. Pick-up arm and shell, with imp. German M.5.T. cartridge. Bargain, **£10. JF3562, Sydney.**

WANTED: One 144MC Receiver or Converter, will give good price. **Mr R. J. Germon, C/- C'wealth Bank of Aust., Kyogle, N.S.W.**

WORK AVAILABLE: Stop switches for electronic organs. We refer to our advertisement in the February issue in this column. Nearly 400 replies were received, and we are quite unable to respond individually; we wish to thank those who replied. A tender has been accepted. **Electronic Organ Co.**

SERVICING: New Books! See our advertisement in this issue regarding two new, low-priced titles on radio and TV servicing. **Electronics Publications (Aust.).**

WANTED: Assembly work. Contract chassis wiring expertly carried out. **Phone XM2880, Sydney.**

ANSWERS TO CORRESPONDENTS

A.D.B. (Caulfield, Vic.) says he has a commercial AC/Battery radio which he wants to use in his car. He wants to know whether the AC inverter described some time ago in these columns would make this possible by turning his 12-volt car supply to 240 volts 100cps.

A. We are not to keen to buy into discussions about what can and can't be done with commercial receivers. It would pre-suppose a complete file of commercial circuits and time to peruse them, added to which possible changes made on our advice may invalidate guarantees, etc. It is one thing to experiment with home-made equipment: quite another when the said equipment is of commercial manufacture. As far as we know, the 100-cycle aspect would not cause any complication. The big danger would be in the possibility of over-running the valves in terms of voltage, either by reason of the unit itself or the high voltage which can appear in a car system when the battery is being charged heavily. AC valves will take a certain amount of abuse but not the frail battery types. On this last count alone, we doubt whether the manufacturers would give the idea their blessing. It is one of those schemes which could be arranged and may work well if everything is just right. But it could equally well lead to trouble.

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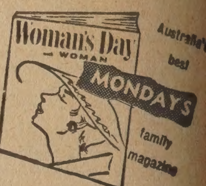

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